1362

Personal Narrative

OF TRAVELS

TO THE

EQUINOCTIAL REGIONS

OF THE

NEW CONTINENT,

DURING THE YEARS 1799—1804,

BY

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AND

AIMÉ BONPLAND;

WITH MAPS, PLANS, &c.

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JOURNEY

TO THE

EQUINOCTIAL REGIONS

OF

THE NEW CONTINENT.

BOOK III.

CHAPTER VI.

Mountains of New Andalusia.—Valley of Cumanacoa.—Summit of the Cocollar.—Missions of the Chayma Indians.

Our first visit to the peninsula of Araya was soon succeeded by a longer and more instructive excursion to the interior of the mountains of the missions of the Chayma Indians, where a variety of interesting objects claimed our attention. We entered on a country studded with forests; and visited a convent surrounded by palm trees and arborescent fern, situate in a narrow valley, where we felt the enjoyment of a cool and delicious climate, in the centre of the torrid zone. The surrounding mountains

contain caverns haunted by thousands of nocturnal birds; and, what affects the imagination more than all the wonders of the physical world, we find beyond these mountains a people so lately nomade, and still nearly in a state of nature, savage without being barbarous, and stupid rather from ignorance than long rudeness. This interesting meditation was blended involuntarily with historical remembrances. It was in the promontory of Paria that Columbus first recognized the continent: there terminate these valleys, alternately devastated by the warlike anthropophagical Carib, and by the commercial and polished nations of Europe. At the beginning of the sixteenth century, the unhappy Indians of the coasts of Carupano, of Macarapan, and of Caraccas, were treated in the same manner as the inhabitants of the coast of Guinea in our days. The soil of the islands was cultivated, the vegetables of the ancient continent were transplanted thither; but the regular system of colonization remained long unknown on the continent. If the Spaniards visited it's shores, it was only to procure, either by violence or exchange, slaves, pearls, grains of gold, and dye-woods. The motives of this insatiable avarice seemed to be ennobled by the pretence of an enthusiastic zeal for religion; for every age has its peculiar tint, and a character appropriate to itself.

The trade in the copper-coloured Indians was accompanied by the same acts of inhumanity as that in the African negroes; and had also the same result, in rendering both the conquerors and the conquered more ferocious. Thence wars became more frequent among the natives; prisoners were dragged from the inland countries to the coast, in order to be sold to the whites, who loaded them with chains in their ships. Yet the Spaniards were at this epocha, and long after, one of the most polished nations of Europe. The resplendent light, which arts and literature then shed over Italy, has been reflected on every country, of which the language emanated from the same source as that of Dante and Petrarch. It might have been thought, that a general melioration of manners would be the natural consequence of this noble awakening of the mind, this sublime soaring of the imagination. But in distant climates, wherever the thirst of wealth has introduced the abuse of power, the nations of Europe, at every period of their history, have displayed the same character. The illustrious era of Leo X was signalized in the new world by acts of cruelty, that seemed to belong to the most barbarous ages. We are less surprised, however, at the horrible picture with which the conquest of America presents us, when we recollect what still takes place on the western

coasts of Africa, notwithstanding the benefits of a more humane legislation.

The principles adopted by Charles V had long abolished the slave-trade on the continent. But the *Conquistadores*, by the continuation of their incursions, prolonged this system of ravaging, which has diminished the American population, perpetuated national animosities, and during a long period crushed the seeds of rising civilization. At length the missionaries, under the protection of the secular arm, spake words of peace. It was the privilege of religion, to console humanity for a part of the evils committed in it's name; to plead the cause of the natives before kings, to resist the violence of the commendataries, and to assemble wandering tribes into small communities, which are called *Missions;* and the existence of which favours the improvement of agriculture. Thus were insensibly founded, though by a uniform and premeditated progress, those vast monastic establishments, that singular system, which continually tends to insulate itself, and places countries four or five times more extensive than France under the control of religious orders.

Institutions, thus useful in stopping the effusion of blood, and in laying the first basis of society, have become in their result hostile to it's progress. The effects of this insulated system have been such, that the Indians have re-

mained in a state little different from that in which they existed, when their scattered dwellings were not yet collected round the habitation of a missionary. Their number has considerably augmented, but the sphere of their ideas is not enlarged. They have progressively lost that vigour of character, and that natural vivacity, which in every state of society are the noble fruits of independence. By subjecting to invariable rules even the slightest actions of their domestic life, they have been rendered stupid, by the effort to render them obedient. Their subsistence is in general more certain, and their habits more pacific; but subject to the constraint and the dull monotony of the government of the missions, they discover by their gloomy and reserved looks, that they have not sacrificed their liberty to their repose without regret. The monastic system confined to the cloister, while it deprives the state of useful citizens, may however sometimes contribute to calm the passions, to sooth incurable sorrows, and fit the mind for meditation; but transplanted into the forests of the new world, applied to the numerous relations of civil society, it has consequences so much the more fatal, as it's duration is prolonged; it enchains from generation to generation the intellectual faculties, interrupts the intercourse of nations, and is hostile to whatever elevates the mind, or enlarges it's con-

ceptions. From these united causes, the natives who inhabit the Missions are kept in a state remote from all improvement; and which we should call stationary, if societies did not follow the course of the human mind, and must therefore be said to retrograde, whenever they cease to go forward.

On the 4th of September, at five in the morning, we began our journey to the Missions of the Chayma Indians, and the group of lofty mountains which traverse New Andalusia. We had been advised, on account of the extreme difficulties of the road, to reduce our baggage to a small bulk. Two beasts of burden were indeed sufficient to carry our provision, our instruments, and the paper necessary to dry our plants. One chest contained a sextant, a dipping-needle, an apparatus to determine the magnetic variation, thermometers, and Saussure's hygrometer. We always selected these instruments in excursions of short duration. The barometer requires more attention even than the time-keeper; and it may be well to add, that this instrument embarrasses travellers more than any other. We confided it during five years to a guide, who followed us on foot; and this precaution, which was expensive, did not always secure it from accidents. Having determined with precision the period of the atmospheric tides, that is, the hours at which the mercury rises and falls

regularly every day under the tropics, we ascertained the possibility of taking the level of the country by means of the barometer, without employing correspondent observations at Cumana. The greatest changes in the pressure of the air in these climates, on the coasts, arise only to 1—1·3 of a line; and if at any given hour, or place, the height of the mercury be once marked, we may with some probability determine the variations, which this height experiences throughout the whole year, at every hour of the day or night *. Hence it results, that, under the torrid zone, the want of correspondent observations can scarcely produce an error exceeding 12 or 15 toises, which is of small importance relative to geological levelling, or the influence of height on the climate, and the distribution of plants.

The morning was deliciously cool. The road, or rather path, that leads to Cumanacoa, follows the right bank of the Manzanares, passing by the hospital of the Capuchins, situate in a small wood of lignum vitæ and arborescent capparis †. On leaving Cumana we enjoyed during the short duration of the twilight,

* See my Astronomical Observations, vol. 1, page 289.

† These caper-trees are called in the country, *pachaca*, *olivo*, *ajito*: they are the capparis tenuisiliqua, Jacq., c. ferruginea, c. *emarginata*, c. *elliptica*, c. *reticulata*, c. *racemosa*.

from the top of the hill of San Francisco, an extensive view over the sea, the plain covered with *bera** and its golden flowers, and the Mountains of the Brigantine. We were struck at the great proximity in which the Cordillera presented itself, before the disk of the rising sun had reached the horizon. The tint of the summits is of a deeper blue, their outline is more strongly marked, and their masses are more detached, as long as the transparency of the air remains undisturbed by the vapours, which, accumulated during the night in the vallies, rise in proportion as the atmosphere acquires warmth.

At the hospital of the *Divina Pastora,* the path turns to the north-east, and stretches for two leagues over a soil without trees, and formerly levelled by the waters. We there found not only cacti, tufts of cistus-leaved tribulus, and the beautiful purple euphorbia †, cultivated in the gardens of the Havanna under the singular name of *dictamno real,* but also the avicennia, the allionia, the sesuvium, the thalinum, and most of the portulaceous plants, that grow on the banks of the gulf of Cariaco. This geographical distribution of plants appears to desig-

* Palo sano, zygophyllum arboreum, Jacq. The flowers have the smell of vanilla.

† Euphorbia tithymaloides.

nate the limits of the ancient coast; and to prove, as we have already observed, that the hills, of which we went along the southern side, formed heretofore a small island, separated from the continent by an arm of the sea.

After walking two hours, we arrived at the foot of the high chain of the interior mountains, which stretches from the east to the west; from the Brigantine to the Cerro de San Lorenzo. There, new rocks appear, and with them another aspect of vegetation. Every object assumes a more majestic and picturesque character; the soil, watered by springs, is furrowed in every direction; trees of gigantic loftiness, and covered with lianas, rise from the ravins; their bark, black and burnt by the double action of the light and the oxygen of the atmosphere, forms a contrast with the fresh verdure of the pothos and dracontium, the tough and shining leaves of which are sometimes several feet long. The parasite monocotyledones take between the tropics the place of the moss and lichens of our northern zone. As we advanced, the forms and grouping of the rocks reminded us of the scenes of Switzerland and the Tyrol. In these American Alps, the heliconia, costus, maranta, and other plants of the family of the balisiers *(canna indica)*, which near the coasts vegetate only in damp and low places, flourish here at considerable height. Thus in the torrid zone,

by a singular similitude, under the influence of an atmosphere continually loaded with vapours, as in the north of Europe * on a soil moistened by melting snows, the vegetation of the mountains offers the same aspect, as characterises the vegetation of marshes.

Before we leave the plains of Cumana, and the breccia, or calcareous sandstone, which constitutes the soil of the seaside, we will notice the different strata, of which this very recent formation is composed, such as we observed it on the back of the hills that surround the Castle of St. Antonio. This is so much the more indispensable, as we shall soon acquire the knowledge of other rocks, which may easily be confounded with the puddingstone of the coast. On advancing toward the interior of the continent, the geological view of those countries will unroll itself gradually before our eyes.

The *breccia* or *calcareous sandstone*, is a local and partial formation, peculiar to the peninsula of Araya †, the coasts of Cumana and Caraccas. We again found it at Cabo Blanco, to the west of the port of Guayra, where it contains, beside broken shells and madrepores, fragments, often angular, of quartz and gneiss. This cir-

* Wahlenberg, de Vegetatione Helvetiæ, et summi Septemtrionis, p. xlvii and lix.

† See vol. ii, p. 263.

cumstance assimilates the breccia to that recent sandstone designated by the German mineralogists by the name of nagelfluhe, and which covers so great a part of Switzerland to the height of a thousand toises *, without presenting any trace of marine productions. Near Cumana the formation of the calcareous breccia contains, first a compact whitish gray limestone, the strata of which, sometimes horizontal, sometimes irregularly inclined, are from five to six inches thick. Some beds are almost unmixed with petrifactions, but in the greatest part the cardites, the turbinites, the ostracites, and shells of small dimensions, are found so closely connected, that the calcareous matter forms only a cement, by which the grains of quartz and the organized bodies are united: 2dly, a calcareous sandstone, in which the grains of sand are much more frequent than the petrified shells; other strata form a sandstone entirely free from organic fragments, yielding but a small effervescence with acids, and enclosing not lamellæ of mica, but nodules of compact brown iron ore: 3d, beds of indurated clay, which contain selenite and lamellar gypsum †. These last beds present a great analogy with the muriatiferous clay of Punta Araya, and appear constantly inferior to the last strata.

* At the Hohgaut, that towers over the Emmethal.

† At the north of St. Antony's castle, very near Cumana.

The breccia, or agglomerate of the seacoast, which we have just described, has a white tint, and lies immediately on the calcareous formation of Cumanácoa, which is of a blueish gray. These two rocks form a contrast no less striking than the *molasse* (bur-stone) of the Pays de Vaud, with the calcareous limestone of the Jura *. It must be observed, that, by the contact of the two formations lying upon each other, the beds of the limestone of Cumanacoa, which I consider as an *Alpine limestone*, are always largely mixed with clay and marl. Lying like the mica-slate of Araya north-east and south-west, they are inclined, near Punta Delgada, under an angle of 60 degrees to the south-east.

We traversed the forest by a narrow path, and went along a rivulet, which rolls foaming over a bed of rocks. We observed, that the vegetation was every where more brilliant, where the Alpine limestone is covered by a quartzose sandstone without petrifactions, and very different from the breccia of the seacoast. The cause of this phenomenon depends probably not so much on the nature of the ground, as on the greater humidity of the soil. The quartzose sandstone contains thin strata of a

* For example, near Aaraw, Boudry, and Porentrui in Switzerland.

blackish clay-slate *, which might easily be confounded with the secondary *thonschiefer;* and these strata hinder the water from filtering into the crevices, of which the Alpine limestone is full. This last offers to the view here, as in the country of Saltzburg, and on the chain of the Apennines, broken and steep beds. The sandstone, on the contrary, wherever it is seated on the calcareous rock, renders the appearance of the scene less savage. The hills which it forms appear more rounded, and the gentler slopes are covered with a thicker mould.

In those humid places, where the sandstone envelopes the Alpine limestone, some trace of cultivation is constantly found. We met with huts inhabited by mestizoes in the ravine of Los Frailes, as well as between the Cuesta of Caneyes, and the Rio Guriental. Each of these huts is placed in the centre of an enclosure, that contains plantains, papaw trees, sugar-canes, and maize. We might be surprised at the small extent of these cultivated spots, if we did not recollect †, that an acre planted with plantains ‡ produces near twenty times as much food as the same space sown with corn. In Europe, our wheat, barley, and rye cover vast spaces of ground; and in general the ara-

* Schieferthon.

† Political Essay on New Spain, Vol. ii. p. 366.

‡ Musa paradisiaca.

ble lands touch each other, wherever the inhabitants live upon corn. It is not the same under the torrid zone, where man has been able to appropriate to himself plants, that yield more abundant and earlier harvests. In these happy climates, the fertility of the soil is proportioned to the heat and humidity of the atmosphere. An immense population finds abundant nourishment on a narrow space, covered with plantains, cassava, yams, and maize. The isolated situation of the huts dispersed through the forest indicates to the traveller the fecundity of nature, where a small spot of cultivated land suffices for the wants of several families.

These considerations on the agriculture of the torrid zone involuntarily remind us of the intimate connexion, that exists between the extent of land cleared, and the progress of society. That richness of the soil, that vigour of organic life, which multiply the means of subsistence, retard the progress of nations toward civilization. Under so mild and uniform a climate, the only urgent want of man is that of food. It is the feeling of this want only, which excites him to labour; and we may easily conceive, why in the midst of abundance, beneath the shade of the plantain and breadfruit tree, the intellectual faculties unfold themselves less rapidly than under a rigorous sky, in the region of corn, where our race is in a perpetual struggle

with the elements. When we take a general survey of countries inhabited by agricultural nations, we observe, that cultivated lands are either separated by forests, or immediately touch each other; not only according to the growth of the population, but the choice of alimentary plants. In Europe we judge of the number of the inhabitants by the extent of the cultivation: under the tropics, on the contrary, in the warmest and most humid parts of South America, very populous provinces appear almost deserted; because man, in order to find nourishment, cultivates but a small number of acres. These circumstances, highly worthy of attention, modify at the same time the physical appearance of the country, and the character of it's inhabitants, giving a peculiar physiognomy to both; something wild and uncultivated, which belongs to nature, the primitive type of which has not yet been altered by art. Without neighbours, almost unconnected with the rest of mankind, each family of settlers forms a separate tribe. This insulated state arrests or retards the progress toward civilization, which advances only in proportion as society becomes more numerous, and it's connexions more intimate and multiplied: but on the other hand, it is solitude that developes and strengthens in man the sentiment of liberty and independence; and gives birth to that noble pride of character, which

has at all times distinguished the Castilian race.

From these causes, the powerful influence of which will often occupy us in the course of this work, the land in the most populous regions of equinoctial America still retains a savage aspect, which is destroyed in the temperate climates by the cultivation of corn. Between the tropics the agricultural nations occupy less ground: man has there less extended his empire; he may be said to appear, not as an absolute master, who changes at his will the surface of the soil, but as a transient guest, who quietly enjoys the gifts of nature. There, in the neighbourhood of the most populous cities, the land remains studded with forests, or covered with a thick mould, never torn up by the plough. Spontaneous plants still predominate by their quantity over cultivated plants, and determine alone the appearance of the landscape. It is probable, that this state of things will change very slowly. If in our temperate climate the cultivation of corn contributes to throw a dull uniformity upon the land we have cleared, we cannot doubt, that, even with an increasing population, the torrid zone will preserve that majesty of vegetable forms, those marks of an unsubdued, virgin nature, which render it so attractive, and so picturesque. Thus it is, that, by a remarkable concatenation of

physical and moral causes, the choice and production of alimentary plants have an influence on three important objects at once; the association or the isolated state of families, the more or less rapid progress of civilization, and the individual character of the landscape.

In proportion as we penetrated into the forest, the barometer indicated the progressive elevation of the land. The trunks of the trees presented here an extraordinary phenomenon; a gramineous plant, with verticillate branches*, climbs, like a liana, eight or ten feet, and forms festoons, which cross the path, and swing about with the wind. We halted, about three o'clock in the afternoon, on a small flat, which is known under the name of Quetepe, and is elevated about one hundred and ninety toises above the level of the sea. A few small houses † have been erected near a spring, well known by the natives for its coolness and great salubrity. We found the water delicious. It's temperature was only 22·5° ‡ of the centigrade thermometer, while that of the air was 28·7°. The

* *Carice*, analogous to the *chusque* of Santa Fe, of the group of the nastuses. This gramineous plant is excellent pasture for mules. See the *Nova Genera et Species Plantarum equin.*, which I am publishing in conjunction with Messrs. Bonpland and Kunth.

† *Habitacion de Don Juan Pelay.*

‡ 18° of Reaumur's thermometer.

springs which descend from the neighbouring mountains of a greater height often indicate a too rapid decrement of heat. If indeed we suppose the mean temperature of the water on the coast of Cumana equal to 26°, we must conclude, unless other local causes modify the temperature of the springs, that the spring of Quetepe acquires it's great coolness at more than 350 toises of absolute elevation *. In speaking of the springs, which gush out in the plains of the torrid zone, or at a small elevation, I must observe in general, that it is only in regions where the mean temperature of summer essentially differs from that of the whole year, that the inhabitants can drink spring water extremely cold during the season of the great heats. The Laplanders, near Umea and Sœrsele, in the 65th degree of latitude, drink spring-water, the temperature of which, in the month of August, is scarcely two or three degrees above the freezing point †; while in the day the heat of the air rises in the shade, in the same northern regions, to 26 or 27 degrees. In the temperate climates of France and Germany, the difference between the air and the springs never exceeds 16 or 17 degrees; between the tropics it seldom rises to 5 or 6

* Vol. II. p. 36, 142, 184.

† Kongl. Vetenks. Acad. Nya Handl., 1809, p. 205.

degrees. It is easy to account for these phenomena, on recollecting, that the interior of the globe, and the subterraneous waters, have a temperature almost identical with the annual mean temperature of the air; and that the latter differs from the mean heat of the summer in proportion to the distance from the equator. The dip of the needle at Quetepe was 42·7° of the centesimal division. The cyanometer indicated for the colour of the sky at the zenith only 14°; no doubt because the season of the rains had begun some days before, and the air was already mingled with vapours *.

From the top of a hill of sandstone, which overlooks the spring of Quetepe, we had a magnificent view of the sea, cape Macanao, and the peninsula of Maniquarez. An immense forest extended itself at our feet to the edge of the ocean. The tops of the trees, intertwined with lianas, crowned with long wreaths of flowers, formed a vast carpet of verdure, the dark tint

* At four in the afternoon; Deluc's hygrometer 48°; centigrade thermometer 26·5°. From Quetepe I found by the compass the bearings of Cape Macanao N. 26° W. The angle between the Cape and the Valley of San Juan in the Island of Margaretta is 29° 28′. The distance in a straight line from Quetepe to Cumana appears to be three leagues and a half.

of which augmented the splendor of the aerial light. The aspect of this spot struck us the more, as we then first beheld those great masses of tropical vegetation. On the hill of Quetepe, at the foot of the malpighia cocollobæfolia, the leaves of which are extremely coriaceous, we gathered, among tufts of the polygala montana, the first melastomas, especially that beautiful species described under the name of the melastoma rufescens. The remembrance of this spot will remain long impressed on our minds. The traveller preserves a fond predilection for those places, where he meets with a group of plants which he had never before beheld in their wild state.

As we advanced toward the south-west, the soil became dry and sandy. We climbed a group of mountains, which separate the coast from the vast plains, or savannahs, bordered by the Oronoko. That part of this group, over which passes the road to Cumanacoa, is destitute of vegetation, and has steep declivities toward both the north and the south. It is designated by the name of the *Impossible*, because it is believed, that, in the case of the landing of an enemy, this ridge of mountains would offer an asylum to the inhabitants of Cumana. We reached the top a little before sunset, and I had scarcely time to take a few horary angles, to

determine the longitude of the place by means of the chronometer *.

• The view from the *Impossible* is finer and more extensive than that from the table-land of Quetepe. We distinguished clearly by the naked eye the flattened top of the Brigantine, the position of which it would be important to fix accurately, the landing-place, and the road of Cumana. The rocky coast of the peninsula of Araya appeared at it's full length. We were particularly struck with the extraordinary configuration of a port, known by the name of Laguna Grande, or Laguna del Obispo. A vast basin, surrounded by high mountains, communicates with the Gulf of Cariaco by a narrow channel, which admits only of the passage of one ship at a time. This port, of which Mr Fidalgo has sketched the plan minutely, is capable of containing several squadrons at once. It is an uninhabited place, but annually frequented by vessels, which carry mules to the

* See my Astronomical Observations, vol. i, page 94. On account of the distance of the southern part of the gulf of Cariaco, the latitude must be nearly 10° 23′. I took the bearings of the road of Cumana, N. 61° 21′ W.; of Cape Macanao, N. 29° 27′ W.; of *Laguna Grande*, on the northern coast of the gulf of Cariaco, N. 3° 10′ W.; of the Cerro del Bergantin, (centre of the Mesa) S. 27° 5′ W.. Shortest distance from the sea 3 or 4 miles. The angles were taken some with a sextant, some with the nautical compass; the latter are corrected by the magnetic variation.

West India Islands. There are some pasture grounds at the bottom of the bay. We traced the sinuosities of this arm of the sea, which, like a river, has dug a bed between perpendicular rocks destitute of vegetation. This singular view reminded us of the back-ground of the fanciful landscape, with which Leonardo da Vinci has decorated his famous portrait of Gioconda *.

We could observe by the chronometer the moment when the disk of the sun touched the horizon of the sea. The first contact was at $6^h\ 8'\ 13''$; the second, at $6^h\ 10'\ 26''$ of mean time. This observation, which is not unimportant for the theory of terrestrial refractions, was made on the summit of the mountain, at the absolute height of 296 toises. The setting of the sun was attended by a very rapid cooling of the air. Three minutes after the last apparent contact of the disk with the horizon of the sea, the thermometer suddenly fell from 25·2° to 21·3°. Was this extraordinary refrigeration owing to some descending current? The air was however calm, and no horizontal wind was felt.

We passed the night in a house where there was a military post of eight men, under the command of a Spanish serjeant. It is an hos-

* Mona Lisa, wife of Francesco del Giocondo.

pital, built by the side of a powder-magazine, and affords every kind of aid to travellers. The same detachment inhabits the mountains five or six months. The post is for the most part occupied by soldiers who have *chacras,* or plantations, in the neighbourhood. When Cumana, after the capture of Trinidad by the English, in 1797, was threatened with an attack, many of the inhabitants fled to Cumanacoa, and deposited what they possessed of most value in sheds hastily constructed on the top of the *Impossible.* It was then resolved, in case of any unforeseen invasion, to abandon the castle of St. Antonio, after a short resistance, and to concentrate the whole force of the province round the mountains, which may be considered as the key of the *Llanos.* The military events, which, in consequence of political revolutions, have since taken place in these countries, have shown how wisely this first plan was framed.

The top of the *Impossible,* as nearly as I could perceive, is covered with a quartzose sandstone, free from petrifactions. It's strata are here, as on the ridge of the neighbouring mountains, pretty regularly directed from N. N. E. to S. S. W.* I have already observed, that this direction is also the most common in the primitive formations in the peninsula of Araya,

* Hor. 3—4 : 45° of southern inclination.

and along the coasts of Venezuela. On the northern declivity of the *Impossible*, near the Pennas Negras, an abundant spring gushes from sandstone, which alternates with a schistous clay. We remarked on this point fractured strata, which lie from N. W. to S. E., and the dip of which is almost perpendicular.

The *Llaneros*, or inhabitants of the plains, send their produce, especially maize, leather, and cattle, to the port of Cumana by the road over the *Impossible*. We continually saw mules arrive, led by Indians or Mulattoes. The solitude of this place recalled forcibly the nights I had passed on the top of St. Gothard. Several parts of the vast forests, which surround the mountain, had taken fire. Reddish flames, half enveloped in clouds of smoke, presented the most aweful spectacle. The inhabitants set fire to the forests, to meliorate the pasturage, and destroy the shrubs, that choke the grass, already so scarce in these countries. Enormous conflagrations too are often caused by the carelessness of the Indians, who neglect, when they travel, to extinguish the fire with which they have dressed their food. These accidents have contributed to diminish the number of old trees in the road from Cumana to Cumanacoa; and the inhabitants observe justly, that, in several parts of their province, the dryness has increased, not only because

every year the frequency of earthquakes causes more crevices in the soil; but also because it is now less furnished with wood than it was at the time of the conquest.

I arose during the night, to determine the latitude of the place by the passage of Fomalhaut over the meridian. The observation was lost, owing to the time which I employed in taking the level of the artificial horizon. It is the great inconvenience of reflecting instruments, when, on account of the mobility of the fluids, we do not use horizons of mercury, of amalgam, or of oil, but those flat glasses, which have been introduced by Mr. von Zach. It was midnight, and I was benumbed with cold, as were also our guides: yet the thermometer kept at 19·7° *. At Cumana I have never seen it sink below 21°; but then the house in which we dwelt on the *Impossible* was 258 toises above the level of the sea. At the Casa de la Polvora I determined the dip of the magnetic needle, which was 42·5° †. The number of oscillations correspondent to 10′ of time was 233. The intensity of the magnetic forces had consequently augmented from the coast to the mountain, perhaps from the influence of some ferruginous matter,

* 15·5° Reaumur's thermometer.

† The magnetic dip is always measured, in this work, according to the centesimal division, if the contrary be not expressly mentioned.

hidden in the strata of sandstone, which cover the Alpine limestone.

We left the *Impossible* on the 5th of September, before sunrise. The descent is very dangerous for beasts of burden; the path being in general but fifteen inches broad, and bordered by precipices. In 1796, the useful project was formed of tracing a fine road from the village of St. Fernando as far as the mountain. A third of this road was even finished: but unfortunately it had been begun in the plain, at the foot of the *Impossible*, so that the most difficult part of the road remained untouched; and the work was suspended by one of those causes, which produce the failure of almost every plan of improvement in the Spanish colonies. Various civil authorities were anxious to assume to themselves the right of directing the works; and the people patiently paid the taxes for a road which did not exist, till the Governor of Cumana put an end to this abuse.

In descending the *Impossible*, the rock of Alpine limestone reappears under the sandstone. The strata being generally inclined to the south and south-east, a great number of springs gush out on the southern side of the mountain. In the rainy season of the year, these springs form torrents, which descend in cascades, shaded by the hura, the cuspa, and the silver-leaved cecropia *.

* Trumpet-tree.

The cuspa, a common tree in the environs of Cumana and of Bordones, is yet unknown to the botanists of Europe. It was long used only for the building of houses, and has become celebrated since 1797, under the name of the cascarilla or bark-tree *(cinchona)* of New Andalusia. It's trunk rises scarcely above fifteen or twenty feet. It's alternate leaves * are smooth, entire, and oval. It's bark, very thin, and of a pale yellow, is eminently febrifuge. It is even more bitter than the bark of the real cinchona, but it's bitterness is less disagreeable. The cuspa is administered with the greatest success, in a spirituous tincture, and in aqueous infusion, both in intermittent and in malignant fevers. The Governor of Cumana, Mr. d'Emparan, sent a considerable quantity of it to the physicians of Cadiz ; and, according to the information lately received from Don Pedro Franco, apothecary to the military hospital at Cumana, the cuspa has been acknowledged in Europe to be almost as good as the quinquina of Santa Fe. It is asserted, that, taken in powder, it has the advantage over the latter of causing less irritation to the stomach of those patients whose gastric system is much debilitated.

On the coasts of New Andalusia, the cuspa

* At the summit of the boughs, the leaves are sometimes opposite to each other, but constantly without *stipulæ*.

is considered as a kind of cinchona; and we were assured, that some Arragonese monks, who had long resided in the kingdom of New Grenada, recognised this tree from the resemblance of it's leaves with those of the real Peruvian bark-tree. This assertion, however, is unfounded; since it is precisely by the disposition of the leaves, and the absence of the stipulæ, that the cuspa differs totally from the trees of the rubiaceous family. It perhaps resembles the family of the honey-suckle, or caprifoliaceous plants, one section of which has alternate leaves, and among which we find several cornel-trees, remarkable for their febrifuge properties *.

The taste, at once bitter and astringent, and the yellow colour of the bark, have alone led to the discovery of the febrifuge virtue of the cuspa. As it blossoms at the end of November, we did not see it in flower, and we know not to what genus it belongs; and I have in vain for several years past asked our friends at Cumana for specimens of the flower and the fruit. I hope, that the botanical determination of the bark-tree of New Andalusia will one day fix the attention of travellers, who visit this region after us; and that they will not confound, not-

* Cornus florida, and c. sericea of the United States. (Walker on the Virtues of the Cornus and the Cinchona compared. Philad. 1803.)

withstanding the analogy of the names, the *cuspa* with the *cuspare*. This last not only vegetates in the missions of the Rio Carony, but also to the west of Cumana, in the gulf of Santa Fe. It furnishes the druggists of Europe with the famous cortex angustura, and forms the genus bonplandia, described by Mr. Willdenouw in the Memoirs of the Academy of Berlin *, from notes communicated to him by us.

It is singular, that, during our long abode on the coast of Cumana and the Caracas, on the banks of the Apura, the Oronoko, and the Rio Negro, in an extent of country of forty thousand square leagues, we never met with one of those numerous species of cinchona, or exostema, which are peculiar † to the low and warm regions of the tropics, especially to the archipelago of the West India Islands. Yet we are far from affirming, that, throughout the whole

* An. 1802, p. 24.

† To the cinchonas of inferior regions (which are almost all exostemas, corollis glabris, filamentis longe exsertis, e bassi tubi nascentibus, seminibus margine integro cinctis) belong c. longiflora of Lambert, c. caribæa, c. angustifolia of Swartz, c. lineata of Wahl, c. philippica of Née. See my botanical and physical Essay on the Cinchonas of the New Continent, in the *Berl. Magazin Naturforsch. Freunde*, 1807, p. 108. The genus exostema was described for the first time in our Equinoctial Plants, vol. 1, page 131, by Messrs. Richard and Bonpland. (Schrader, Journ. fuer die Botanik, B. 1, p. 358.

of the eastern part of South America, from Portocabello to Cayenne, or from the equator to the 10th degree of North latitude, between the meridians of 54 and 71 degrees, the cinchona absolutely does not exist. Can we boast of knowing completely the Flora of so vast an extent of country? But when we recollect, that even at Mexico no species * of the genera cinchona and exostema has been discovered, either in the central table-land, or in the plains, we are led to believe, that the mountainous islands of the West Indies and the Cordillera of the Andes have peculiar Floras; and that they possess groups of vegetables, which have neither passed from the islands to the continent, nor from South America to the coasts of New Spain.

It may be observed farther, that, when we reflect on the numerous analogies, which exist

* The cinchona angustifolia, and the c. longiflora, have never been found in New Spain, or Cayenne, notwithstanding what has recently been asserted. (Lambert, Descrip. of the Genus Cinchona, 1797, p. 38, Bulletin de Pharmacie, 1812, p. 492.) Mr. Richard, who resided long in French Guiana, after Oublet, affirms, that no new kind of cinchona has been there discovered. The specimen of the c. longiflora, that Mr. Lambert cites in his interesting Monography, as taken from Oublet's herbal, came probably from St. Domingo; at least Wahl recognised among the West Indian plants of Mr. Jussieu's collection the c. longiflora. Is the bark of Grand Para (c. brasiliensis, Hofmansegg) a true cinchona? or does it belong to the genus machaonia?

between the properties of vegetables and their external form, we are surprised to find qualities eminently febrifuge in the bark of trees belonging to different genera, and even different families*. Some of these barks so much resem-

* "It may be somewhat interesting to chemistry, physiology, and descriptive botany, to consider under the same point of view the plants, that have been employed in intermittent fevers with different degrees of success. We find among the *rubiaceous* plants, beside the cinchonas and exostemas, the coutarea speciosa, or Cayenne bark, the portlandia grandiflora of the West Indies, another portlandia discovered by Mr. Sesse at Mexico, the pinkneia pubescens of the United States, the berry of the coffee tree, and perhaps the macrocnemum corymbosum, and the guettarda coccinea; among the *magnoliaceous*, the tulip tree and the magnolia glauca; among the *zanthoxylaceous*, the cuspare of Angustura, known in America under the name of Oronoko bark, and the zanthoxylon caribæum; among the *leguminous*, the geoffræas, the swietenia febrifuga, the æschynomene grandiflora, the cæsalpinea bonducella; among the *caprifoliaceous*, the cornus florida, and the cuspa of Cumana; among the *rosaceous*, the cerasus virginiana, and the geum urbanum; among the *amentaceous*, the willows, oaks, and birch trees, of which the alcoholic tincture is used in Russia by the common people, the populus tremuloides, &c.; among the *annonaceous*, the uvaria febrifuga, the fruit of which we saw administered with success in the Missions of Spanish Guiana; among the *simaroubaceous*, the quassia amara, celebrated in the feverish plains of Surinam; among the *terebinthinaceous*, the rhus glabrum; among the *euphorbaceous*, the croton cascarilla; among the *composite*, the eupatorium perfoliatum, the febrifuge qualities of which are known to the savages of North America (Grindel's Chinasurrogat, Dorpat,

ble each other, that it is easy to confound them at first sight. But before we examine the question, whether we shall one day discover, in the real cinchona, in the cuspa of Cumana, the cortex angusturæ, the Indian swietenia, the willows of Europe, the fruits of the coffee tree and uvaria, a matter uniformly diffused, and exhibiting, (like starch, caoutchouc, and camphor) the same chemical properties in different plants, we may ask in general, whether, in the present state of physiology and medicine, a febrifuge principle ought to be admitted. Is it not probable, rather, that this particular derangement in the organization, which is known under the vague name of the febrile state, and in which both the vascular and the nervous systems are

1809. Renard ueber inland. Surrogate der Chinarinde, Mainz, 1809. Decandolle, sur les Propriétés médicales des Plantes, 1816, p. 73, 129, 138, 142, 165, 171, 179. Rogers, on the Properties of the Liriodendron tulipifera, Philad. 1802.) It is the bark of the roots, that is used in the tulip tree, as in the quassia. Eminent febrifuge virtues have equally been found at Loxa, in the cortical part of the roots of the cinchona condaminea; but it is happy, for the preservation of the species, that the roots of the real cinchona are not employed in pharmacy. Chemical researches are yet wanting upon the very powerful bitters contained in the roots of the zanthoriza apiifolia, and the actæa racemosa: the latter have sometimes been employed with success against the epidemical yellow fever in New York.

at the same time attacked, yields to remedies which do not operate by the same principle, by the same mode of action on the same organs, by the same play of chemical and electrical attractions? We shall here confine ourselves to this observation, that, in the species of the genus cinchona, like antifebrile virtues do not appear to reside in the *tannin* (which is only accidentally mingled in them), or in the cinchonat of lime; but in a resiniform matter, soluble both by alcohol and by water, and which, it is believed, is composed of two principles, the *cinchonic bitter* and the *cinchonic red* *. Can it then be admitted, that this resiniform matter, which possesses different degrees of energy according to the combinations by which it is modified, is found in all the febrifuge substances? Those by which the sulphat of iron is precipitated of a green colour, like the real cinchona, the bark of the white willow, and the horned perisperm of the coffee tree, do not on this account indicate an identity of chemical composition†;

* In French, *l'amer et le rouge cinchoniques.*

† The cuspare bark (cort. angusturæ) yields with iron a yellow precipitate; yet it is employed on the banks of the Oronoko, and particularly at the town of St. Thomas of Angustura, as an excellent cinchona; and on the other hand, the bark of the common cherry tree, which has scarcely any febrifuge quality, yields a green precipitate like the real cinchonas. (Vauquelin, Annales de Chimie, T. 59, page 143. Reuss, in the Journal de Pharmacie, 1815, page 505.

and this identity might exist, without our concluding thence, that the medical virtues were analogous. We see, that the different species of *sugar* and *tannin*, when they are extracted from plants not of the same family, display numerous differences: while the comparative analysis of sugar, gum, and starch; the discovery of the radical of the prussic acid, the effects of which are so powerful on the organization; and so many other phenomena of vegetable chemistry; clearly prove, that "substances composed of a small number of identical elements, and in the same proportion, exhibit the most heterogeneous properties," on account of that particular mode of combination, which corpuscular chemistry calls the arrangement of the particles *.

On coming out of the ravine which descends from the *Impossible*, we entered a thick forest traversed by a great number of small rivers †,

Grindel, Russisches Jahrb. der Pharm. 1808, p. 183). Notwithstanding the extreme imperfection of vegetable chemistry, the experiments already made on cinchonas sufficiently show, that to judge of the febrifuge virtues of a bark, we must not attach too much importance either to the principle that turns to green the oxides of iron, or to the tannin, or to the matter that precipitates infusions of tan.

* Gay-Lussac, Exp. on Jodine, page 149, note 1. (Humb. Vers. ueber gereizte Muskelfaser, B. 1, p. 128.)

† The Manzanares; the Cedeno, with a plantation of cacao trees, and an hydraulic wheel; the Vichoroco; the Lucas-

which are easily forded. We observed, that the cecropia, which by the disposition of it's branches, and it's slender trunk, resembles the port of the palm tree, is covered with leaves more or less silvery, in proportion as the soil is dry or moist. We saw some plants of it, the leaf of which was on both sides entirely green *. The roots of these trees are hid under tufts of dorstenia, which flourishes only in humid and shady places. In the midst of the forest, on the banks of the Rio Cedeno, as well as on the southern declivity of the Cocollar, we find, in their wild state, papaw trees, and orange trees with large and sweet fruit. These are probably the remains of some *conucos*, or Indian plantations; for in those countries the orange tree cannot be counted among the indigenous plants, any more than the banana tree, the papaw tree, maize, cassava, and so many other useful plants, with the true country of which we are unacquainted, though they have accompanied man in his migrations from the remotest times.

When a traveller newly arrived from Europe penetrates for the first time into the forests of South America, nature presents herself to him under an unexpected aspect. The objects that

perez, with a habitation that is called *Pie de la Cuesta*; the Rio St. Juan; &c.

* Is not the cecropia concolor of Willdenouw a variety of the cecropia peltata?

surround him recall but feebly those pictures, which celebrated writers have traced on the banks of the Missisippi, in Florida, and in other temperate regions of the new world. He feels at every step, that he is not on the confines, but in the centre of the torrid zone: not in one of the West India islands, but on a vast continent, where every thing is gigantic, the mountains, the rivers, and the mass of vegetation. If he feel strongly the beauty of picturesque scenery, he can scarcely define the various emotions, which crowd upon his mind; he can scarcely distinguish what most excites his admiration, the deep silence of those solitudes, the individual beauty and contrast of forms, or that vigour and freshness of vegetable life, which characterize the climate of the tropics. It might be said that the earth, overloaded with plants, does not allow them space enough to unfold themselves. The trunks of the trees are every where concealed under a thick carpet of verdure; and if we carefully transplanted the orchideæ, the pipers, and the pothos, which a single courbaril, or American fig-tree* nourishes, we should cover a vast extent of ground. By this singular assemblage, the forests, as well as the flanks of the rocks and mountains, enlarge the domains of organic nature. The same

* Ficus gigantea.

lianas as creep on the ground, reach the tops of the trees, and pass from one to another at the height of more than a hundred feet. Thus by a continual interlacing of parasite plants, the botanist is often led to confound the flowers, the fruits, and leaves, which belong to different species.

We walked for some hours under the shade of these arcades, that scarcely admit a glimpse of the sky; which appeared to me of an indigo blue, so much the deeper as the green of the equinoctial plants is generally of a stronger hue, with somewhat of a brownish tint. A great fern tree *, very different from the polypodium arboreum of the West Indies, rose above masses of scattered rocks. In this place we were struck for the first time with the sight of those nests in the shape of bottles, or small pockets, which are suspended to the branches of the lowest trees, and which attest the admirable industry of the orioles, that mingle their warblings with the hoarse cries of the parrots and the macaws. These last, so well known for their vivid colours, fly only in pairs, while the real parrots wander about in flocks of several hundreds. A man must have lived in those climates, particularly in the hot valleys of the Andes, to conceive how these birds sometimes drown with their voice

* Perhaps our aspidium caducum.

the noise of the torrents, which rush down from rock to rock.

We left the forests, at the distance of somewhat more than a league from the village of San Fernando. A narrow path led, after many windings, into an open, but extremely humid country. In the temperate zone, the cyperaceous and gramineous plants would have formed vast meadows; here the soil abounded in aquatic plants, with sagittate leaves, and especially in basil plants, among which we noticed the fine flowers of the costus, the thalia, and the heliconia. These succulent plants are from eight to ten feet high, and in Europe their assemblage would be considered as a little wood. The delightful view of meadows, and of turf sprinkled with flowers, is almost entirely wanting in the low regions of the torrid zone, and is to be found only in the elevated plains of the Andes.

Near St. Fernando, the evaporation caused by the action of the sun was so great, that, being very lightly clothed, we felt ourselves as wet as in a vapour bath. The road was bordered with a kind of bamboo *, which the Indians call iagua, or guadua, and which is more than forty feet in height. Nothing equals the elegance of this arborescent gramen. The form and disposition of it's leaves give it a charac-

* Bambusa guadua. (See Plate 20 of our Equinoxial Plants, T. 1, p. 68.)

ter of lightness, which forms an agreeable contrast with it's height. The smooth and glossy trunk of the iagua is generally bent towards the banks of rivulets, and waves with the slightest breath of air. Whatever be the height of the reed* in the south of Europe, it can give no idea of the aspect of the arborescent gramina, and, if I might presume to refer to my own feelings, I should assert, that the bamboo and fern tree are, of all the vegetable forms between the tropics, those which most powerfully strike the imagination of the traveller.

I shall not enter into the details of descriptive botany, to prove that the bamboos of the East Indies, *calumets of the heights*† of the isle of Bourbon, the guaduas of South America, and even perhaps the gigantic arundinarias of the banks of the Missisippi, belong to the same group of plants. These discussions are confined to another work, devoted exclusively to the description of the new genera and species, which we brought back from our travels‡. It is sufficient here to observe in general, that the bamboos are less common in America than is usually believed. They are almost entirely wanting in the marshes

* Arundo donax.

† Bambusa, or rather the nastus alpina.

‡ Nov. Gen. et Species, vols 1, p. 201 and 241 of the 4to edition. The two continents produce each of them different species of nastus and bambusa.

and vast inundated plains of the lower Oronoko, the Apure, and the Atabapo, while they form thick woods, several leagues in length, in the north west, in New Grenada, and in the kingdom of Quito. We might assert, that the western declivity of the Andes is their true country; and, what is remarkable enough, we found them not only in the low regions, at the level of the ocean, but also in the lofty vallies of the Cordilleras at the height of 860 toises.

The road skirted with bamboos led us to the small village of San Fernando, which is situate in a narrow plain, surrounded by very steep calcareous rocks. This was the first Mission * we saw in America. The houses, or rather the huts of the Chayma Indians, separated from each other, are not surrounded by gardens. The streets, which are wide and very straight, cross each other at right angles. The walls, which are very thin and slight, are made of clay, strengthened by lianas. The uniformity of this construction, the grave and taciturn air of the

* A certain number of habitations collected round a church, a missionary monk performing the ministerial duties, is called in the Spanish Colonies *Mision* or *Pueblo de mision*. Indian villages, governed by a priest, are called *Pueblos de doctrina*. They make a distinction between the *Cura doctrinero*, who is the priest of an Indian parish, and the *Cura rector*, priest of a village inhabited by whites and men of mixed race.

inhabitants, and the extreme neatness that reigns throughout their habitations, reminded us of the establishments of the Moravian Brethren. Every Indian family cultivates, at some distance from the village, beside it's own garden, the *conuco** of the community. In this the adults of each sex work one hour in the morning, and one in the evening. In the missions nearest the coast, the garden of the community is generally a sugar or indigo plantation, under the direction of the missionary; and the produce of which, were the law strictly observed, can be employed only for the support of the church, and the purchase of the sacerdotal ornaments. The great square of San Fernando, in the centre of the village, contains the church, the dwelling of the missionary, and that humble edifice, which is pompously called the king's house—*Casa del Rey*. This is a real caravanserai, destined to lodge travellers; and, as we often experienced, infinitely valuable in a country, where the name of an inn is still unknown. The *Casas del Rey* are to be found in all the Spanish colonies, and may be deemed an imitation of the *tamboes* of Peru, established according to the laws of Manco Capac.

We had been recommended to the friars, who govern the Missions of the Chayma Indians, by

* *Çonuco de la comunidad.*

their syndic, who resides at Cumana. This recommendation was so much the more useful to us, as the missionaries, either from zeal for the purity of the morals of their parishioners, or to conceal the monastic system from the indiscreet curiosity of strangers, often adhere with rigor to an old regulation, by which a white man of the secular state is not permitted to sojourn more than one night in an Indian village. In order to travel agreeably in the Spanish Missions, it would be in general imprudent, to trust solely to a passport issued by the Secretary of State's office at Madrid, or that of the civil governors. A traveller must provide himself with recommendations from the ecclesiastical authorities, particularly from the guardians of the convents, or the generals of the orders, residing at Rome; who are infinitely more respected by the missionaries, than are the bishops. The Missions form, I will not say according to their primitive and canonical institutions, but in fact, a distinct and nearly independent hierarchy, the views of which seldom accord with those of the secular clergy.

The missionary of San Fernando was a capuchin, a native of Arragon, far advanced in years, but strong and healthy. His extreme corpulency, his hilarity, the interest he took in battles and sieges, ill accorded with the ideas we form in our northern countries of the melan-

choly reveries, and the contemplative life of missionaries. Though extremely busy about a cow, which was to be killed the next day, the old monk received us with kindness, and permitted us to hang up our hammocks in a gallery of his house. Seated, without doing any thing, the greater part of the day, in an arm chair of red wood, he bitterly complained of what he called the indolence and ignorance of his countrymen. He asked a thousand questions on the real object of our journey, which appeared to him hazardous, and at all events useless. Here, as at Oronoko, we were fatigued by that restless curiosity, which the Europeans preserve in the forests of America, respecting the wars and political convulsions of the Old World.

Our missionary, however, seemed well satisfied with his situation. He treated the Indians with mildness; he beheld his Mission prosper, and he praised with enthusiasm the waters, the bananas, and the dairy produce of the canton. The sight of our instruments, our books, and our dried plants, drew from him a sarcastic smile; and he acknowledged, with the *naïveté* peculiar to those climates, that of all the enjoyments of life, without excepting sleep, none was comparable to the pleasure of eating good beef *(carne de vacca)*; so true it is, that sensuality obtains an ascendancy, where there is no occu-

pation for the mind. Our host often engaged us to pay a visit with him to his cow, which he had just purchased; and on the morrow, at sunrise, he would not dispense with our seeing it killed after the fashion of the country, that is, by ham-stringing the animal, and then plunging a large knife into the vertebræ of the neck. This disgusting operation served to show us the great address of the Chayma Indians, eight of whom, in less than twenty minutes, cut up the animal into small pieces. The price of the cow was only seven piastres; but this price seemed to be thought very considerable. The same day the missionary had paid eighteen piastres to a soldier of Cumana, for having succeeded, after many fruitless attempts, in bleeding him in the foot. This fact, though seemingly very unimportant, is a striking proof how greatly, in uncultivated countries, the price of things differs from that of labor.

The Mission of San Fernando was founded toward the end of the 17th century, near the junction of the small rivers of the Manzanarès and Lúcasperez *. A fire, which consumed the church, and the huts of the Indians, induced the capuchins to place the village in it's present fine situation. The number of families is increased to one hundred, and the missionary ob-

* Caulin, Hist. corogr. de la Nueva Andalusia, p. 309.

served to us, that the custom of marrying at thirteen or fourteen years of age contributes greatly to this rapid increase of population. He denied that old age was so premature among the Chaymas, as is commonly believed in Europe. The government of these Indian parishes is very complicated; they have their governor, their major-alguazils, and their militia-commanders, who are all copper-coloured natives. The company of archers have their colors, and perform their exercise with the bow and arrow, in shooting at a mark; this is the *national guard* [militia] of the country. This military establishment, under a purely monastic system, seemed to us very singular.

On the night of the 5th of September, and the following morning, there was a thick fog; yet we were however not more than a hundred toises above the level of the sea. I determined geometrically, at the moment of our departure, the height of the great calcareous mountain, that rises at 800 toises distance to the south of San Fernando, and forms a perpendicular cliff on the north side. It is only 215 toises higher than the great square; but naked masses of rock, which here exhibit themselves in the midst of a thick vegetation, give it a very majesic aspect *.

* The base, directed toward the mountain, was 290 feet. Angles of altitude, 14° 25′ 6″, and 15° 17′ 36″. Barometer,

The road from San Fernando to Cumaña passes amidst small plantations, through an open and humid valley. We forded a number of rivulets. In the shade the thermometer did not keep above 30°: but we were exposed to the direct rays of the sun, because the bamboos, which skirted the road, afforded but small shelter, and we suffered greatly from the heat. We passed through the village of Arenas, inhabited by Indians, who are of the same race as those of San Fernando. But Arenas is no longer a Mission; and the natives, governed by a regular priest *, are better clothed, and more civilized. Their church is also known in the country on account of some rude paintings. A narrow border encloses figures of armadilloes, caymans, jaguars, and other animals peculiar to the new world.

In this village lives a labourer, Francisco Lozano, who presented a physiological phenomenon, highly calculated to strike the imagination, though it is very conformable to the known laws of organized nature. This man has suckled a

67 lines lower than at Cumana. Height above the level of the sea, 215 + 93 = 308 toises. From the great square at San Fernando, the mountain of the Impossible lies N. 74° W., and the town of Cumanacoa, S. 41° E.

* The four villages of Arenas, Macarapana, Mariguitar, and Aricagua, founded by Arragonese Capuchins, are called *Doctrinas de Encomienda.*

child with his own milk. The mother having fallen sick, the father, to quiet the infant, took it into his bed, and pressed it to his bosom. Lozano, then thirty-two years of age, had never remarked till that day that he had milk: but the irritation of the nipple, sucked by the child, caused the accumulation of that liquid. The milk was thick and very sweet. The father, astonished at the increased size of his breast, suckled his child two or three times a day during five months. He drew on himself the attention of his neighbours, but he never thought, as he probably would have done in Europe, of deriving any advantage from the curiosity he excited. We saw the certificate, which had been drawn up on the spot, to attest this remarkable fact, eye-witnesses of which are still living. They assured us, that, during this suckling, the child had no other nourishment than the milk of his father. Lozano, who was not at Arenas during our journey in the Missions, came to us at Cumana. He was accompanied by his son, who was then thirteen or fourteen years of age. Mr. Bonpland examined with attention the father's breast, and found it wrinkled like those of women who have given suck. He observed, that the left breast in particular was much enlarged; which Lozano explained to us from the circumstance, that the two breasts did not furnish milk in the same abundance. Don Vicente Empa-

ran, Governor of the province, sent a circumstantial account of this phenomenon to Cadiz.

It is not a very uncommon circumstance, to find, both among humankind and animals *, males whose breasts contain milk; and the climate does not appear to exert any marked influence on the more or less abundance of this secretion. The ancients cite the milk of the he goats of Lemnos and Corsica. In our own time, we have seen in the country of Hanover, a he goat, which for a great number of years was milked every other day, and yielded more milk than a female goat †. Among the signs of the pretended weakness of the Americans, travellers have mentioned the milk contained in the breasts of men ‡. It is however improbable, that it has ever been observed in a whole tribe, in some part of America unknown to modern travellers; and I can affirm, that at present it is not more common in the new continent, than in the old. The labourer of Arenas, whose history we have just related, is not of the copper-

* Athanas. Joannides de Mammarum Struct., 1801, p. 6. Haller, Elem. Physiol., T. 7, P. II. page 18.

† Blumenbach, Vergleich. Anat., 1805, p. 504. Hanœvrisches Magaz., 1787, page 753. Reil, Arch. der Physiol., T. 3, p. 449. Montegre, Gazette de Santé, 1812, p. 110.

‡ It has even been seriously related, that in a part of Brazil it is the men, and not the women, that suckle children. Clavigero, Storia di Messico. T. 4. 169.

coloured race of Chayma Indians: he is a white man, descended from Europeans. Moreover, the anatomists of Petersburg * have observed, that among the lower orders of the people in Russia, milk in the breasts of men is much more frequent, than among the more southern nations; and the Russians have never been deemed weak and effeminate.

There exists among the varieties of our kind a race of men, whose breasts at the age of puberty acquire a considerable bulk. Lozano did not belong to this class; and he often repeated to us, that it was only the irritation of the nipple, in consequence of the suction, which caused the flow of the milk. This confirms the observation of the ancients, "that men, who have a small quantity of milk, yield it in abundance, when their breasts are sucked †." These singular effects of a nervous stimulant were known to the shepherds of Greece; those of Mount Oeta rubbed the dugs of the young goats, that had not yet conceived, with nettles, to make them produce milk.

When we reflect on the whole of the vital phenomena, we find, that no one of them is entirely isolated. In every age examples are cited of young girls not marriageable, or women wi-

* Comment. Petrop., Tom. 3, p. 278.

† Arist., Hist Anim., lib. 3, cap. 20, ed. Duval, 1639, Tom. 2, p. 259.

thered by age, who have suckled children. Among men these examples are infinitely more rare; and after numerous researches, I have not found above two or three. One is cited by the anatomist of Verona, Alexander Benedictus, who lived toward the end of the fifteenth century. He relates the history of an inhabitant of Syria *, who, to calm the uneasiness of his child, after the death of the mother, pressed it to his bosom. The milk immediately came with such abundance, that the father could take on himself the nourishment of his child, without assistance. Other examples are related by Santorellus, Paria, and Robert, bishop of Cork †. The greater part of these phenomena having been noticed in times very remote, it is not uninteresting to physiology, that we can confirm them in our own days. Besides, they bear very strongly on the long disputed question respecting final causes. The existence of

* Maripetrus sacri ordinis equestris tradidit, Syrum quemdam, cui filius infans, mortua conjuge, supererat, ubera sæpius admovisse, ut famem filii ragientis frustraret, continuatoque suctu lacte manasse papillam; quo exinde nutritus est, magno totius urbis miraculo. Alex. Benedicti hum. Corp. Anatome, Bas., 1549, lib. 3, cap. 4, p. 595. Barthol. Vindic. Anatom., 1648, p. 32.

† Gabr. Rzaczynski, Hist. natur. Cur. Sandomir., 1721, p. 332. Misc. Acad. Nat. Cur., 1688, p. 219. Phil. Trans. 1741, p. 810.

the nipple in men has long puzzled philosophers; and it has even been recently affirmed, "that Nature has refused to one of the sexes the faculty of sucking, because this faculty would not accord with the dignity of man *."

On approaching the town of Cumanacoa, we found a more level soil, and a valley enlarging itself progressively. This small town is situate in a naked plain, almost circular, surrounded by lofty mountains, having a dull and melancholy aspect. It's population is scarcely two thousand three hundred inhabitants; in the time of Father Caulin †, in 1753, it was only six hundred. The houses are low and slight, and, with the exception of three or four, all built of wood. We succeeded however in placing our instruments advantageously enough in the house of the administrator of the duties on tobacco, Don Juan Sanchez, an amiable man, with much quickness of understanding. He had prepared for us a spacious and commodious abode, where we spent four days, and he obligingly accompanied us in all our excursions.

Cumanacoa was founded in 1717 by Domin-

* Comment. Petrop., Tom. 3, p. 277.

† Hist. Cor., p. 309 et 217. Recent travellers make the population of Cumanacoa amount to 5000 souls. But I have already observed (Chap. 4, Vol. II, p. 201), that it is in consequence of researches made with the king's officers, and intelligent planters, that I have assigned a smaller number.

go Arias *, at the return of an expedition to the mouth of the Guarapiche, in order to destroy an establishment, which some French freebooters had attempted to found. The new town was first called San Baltazar de las Arias; but the Indian denomination prevailed: as the name of Santiago de Leon, which is still to be met with in our maps, is forgotten in that of Caraccas.

On opening the barometer, we were struck at seeing the column of mercury scarcely 7·3 lines shorter than on the coasts: yet the instrument appeared to be no way deranged. The plain, or rather the table land, on which the town of Cumanacoa is situate, is not more than 104 toises above the level of the sea, which is three or four times less than is supposed by the inhabitants of Cumana, on account of their exaggerated ideas of the cold of Cumanacoa. But the difference of climate, which is observed between places so near each other, is perhaps less owing to the height of the spot, than to local circumstances; among which we shall cite the proximity of the forests; the frequency of descending currents, so common in these valleys, closed on every side; the abundance of rain; and those thick fogs, which

* Father Caulin affirms, that the valley, in which Arias built for the first time, was known very anciently under the name of Cumanacoa. But the inhabitants of Biscay claim the termination *coa*, as signifying depending on Cumana, as in Jaungoicoa, Basocoa, &c.

diminish during a great part of the year the direct action of the solar rays. The decrement of the heat being nearly the same between the tropics *, and during the summer under the temperate zone, the small difference of level of one hundred toises should produce only a change in the mean temperature of 1° or 1·5°. But we shall soon find, that at Cumanacoa the difference rises to more than four degrees. This coolness of the climate is sometimes the more surprising, as very strong heats are felt in the town of Carthago †; at Tomependa, on the bank of the river of Amazons; and in the valleys of Aragua, to the west of Caraccas; though the absolute height of these different places is between 200 and 480 toises. In plains, as well as on mountains, the *isothermal lines* [lines of similar heat] are not constantly parallel to the equator, or the surface of the globe ‡. It is the grand problem of meteorology, to determine the inflections of these lines, and to discover, amid modifications produced by local causes, the constant laws of the distribution of heat.

* See my memoir on horizontal refractions, in my Ast. Obs., Vol. I, p. 129 and 141: and in the present work, vol. I, p. 146, 185, 261.

† In the province of Popayan, the heat is caused by the reverberation of the plains.

‡ See my Prolegomena de Distributione geographicâ Plantarum, secundum Cœli Temperiem et Altitudinem Montium, in the Nov. Gen. et Spec., Tom. I, p. 28, 4to. edition.

The port of Cumana is only seven nautical leagues * from Cumanacoa. It scarcely ever rains in the first of these two places, while in the second there are seven months of wintery weather. At Cumanacoa, the dry season begins at the winter solstice, and lasts till the vernal equinox. Light showers are frequent in the months of April, May, and June. At this epoch the dry weather takes place again, and lasts from the summer solstice to the end of August. Then come the real winter rains, which cease only in the month of November, and during which torrents of water pour down from the skies. According to the latitude of Cumanacoa, the sun passes by the zenith of the place the first time on the 16th of April, and the second, on the 27th of August. It appears by what I have said, that these two passages coincide with the beginning of the rains, and the great electrical explosions.

It was during the winter season that we took up our first abode in the Missions. Every night a thick fog covered the sky, like a veil uniformly extended; and it was only at intervals, that I succeeded in taking some observations of the

* The itinerary distance reckoned in the country is 12 leagues: but these leagues contain scarcely 2000 toises. I have deduced the real distance from astronomical observations made at Cumana and Cumanacoa, and published in 1806.

stars. The thermometer kept from 18·5° to 20°*; which under this zone, and to the feelings of a traveller who comes from the coasts, appears a very great coolness. I never perceived the temperature in the night at Cumana below 21°. The hygrometer of Deluc indicated, at Cumanacoa, 85°; and, what is remarkable enough, when the vapours were dispersed, and the stars shine in their full brilliancy, the instrument fell to 55°. This difference in dryness of 30° would have made Saussure's hygrometer vary only 11°. Toward morning the temperature augmented slowly, on account of the force of the evaporation; and at 10 o'clock it did not yet rise above 21°. The greatest heats are felt from noon to 3 o'clock; the thermometer keeping between 26° and 27°. The maximum of the heat, which took place about two hours after the passage of the sun over the meridian, was very regularly marked by a storm, that murmured near. Large black and low clouds dissolved in rain, which came down in torrents; and these showers lasted two or three hours, and sunk the thermometer five or six degrees. About five o'clock, the rain entirely ceased; the sun reappeared a little before it set; and the hygrometer moved toward the point of dryness; but at eight or nine we were again enveloped

* From 14·8° to 16° of Reaumur.

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in a thick stratum of vapours. These different changes follow successively, we were assured, during whole months; and yet not a breath of wind is felt. Comparative experiments led us to believe, that in general the nights at Cumanacoa are from two to three, and the days from four to five centesimal degrees cooler, than at the port of Cumana. These differences are great; and if, instead of meteorological instruments, we consulted only our own feelings, we should suppose they were still more considerable *.

The vegetation of the plain that surrounds the town is monotonous, but, owing to the extreme humidity of the air, remarkable for it's freshness. It is chiefly characterized by an arborescent solanum, which is forty feet in height,

* Cumanacoa, 1799, Sept. the 6th, midnight: thermometer, 15·7° of Reaumur: De Luc's hygrometer, 85° (foggy). The 7th, at the same hour: thermom., 14·8° Reaum.; hygrom., 85·8°. At 25′ after 12: therm., 16·4° R.; hygrom., 55·3° (starlight). At 4′ after 1, therm., 15° R.; hygr., 82° (sky cloudy, mist; lunar rainbow; lightning without thunder [*éclairs de chaleur*] at a distance). Sept. the 9th, at 8 o'clock in the morning: therm., 17·2° R.; hygr., 72° (sky cloudy). At 45′ after 1: therm., 22° R.; hygr., 48°. At 7, after the rain and thunderstorm: therm., 17·3° R.; hygr., 52°. At 10 in the evening: therm., 16·4° R.; hygr., 82° (foggy). The valley of Cumanacoa is very subject to thunderstorms. It is affirmed, that in the month of October thunder is heard the greater part of every day.

the urtica baccifera, and a new species of the genus guettarda *. The ground is very fertile, and might even be easily watered, if trenches were cut from a great number of rivulets, the springs of which never dry up during the whole year. The most valuable production of the district is tobacco; it is also the only one, that has given some reputation to a town so small, and so ill built. Since the introduction of the *farm* † in 1779, the cultivation of tobacco in the province of Cumana is nearly confined to the valley of Cumanacoa; as in Mexico it is permitted only in the two districts of Orizaba and Cordova. The system of the *farm* is a monopoly odious to the people. All the tobacco that is gathered must be sold to government; and to prevent, or rather to diminish fraud, it has been found easiest to concentrate the cultivation in one point. Guards scour the country, to destroy any plantations without the boundaries of the privileged districts; and inform against those inhabitants, who dare smoke segars prepared by their own hands. These

* These trees are surrounded by galega pilosa, stellaria rotundifolia, ægiphila elata of Swartz, sauvagesia erecta, martinia perennis, and a great number of rivinas. We find among the gramineous plants, in the savanna of Cumanacoa, the paspalus lenticularis, panicum adscendens, pennisetum uniflorum, gynerium saccharoides, eleusine indica, &c.

† *Estanco real de tabaco*, royal monopoly of tobacco.

guards are for the most part Spaniards, and are almost as insolent as those we see employed in similar cases in Europe. This insolence has not a little contributed to foster the hatred between the colonies and the metropolis.

Next to the tobacco of the isle of Cuba, and of the Rio Negro, that of Cumana is the most aromatic. It excels all the tobacco of New Spain, and of the province of Varinas. We shall give some particulars of it's culture, as it is essentially different from that which is practised in Virginia. The prodigious expansion which is remarked in the *solaneous* plants of the valley of Cumanacoa, especially in the abundant species of the solanum arborescens, of aquartia, and of cestrum, seems to indicate how favourable this spot is for plantations of tobacco. The seed is sowed in the open ground, at the beginning of September; though sometimes not till the month of December, which is less favorable for the harvest. The cotyledons appear on the eighth day: and the young plants are covered with large leaves of heliconia or plantain, to shelter them from the direct action of the sun. Great care also is taken to destroy the weeds, which, between the tropics, spring up with astonishing rapidity. The tobacco is transplanted into a rich and well prepared ground, a month or two after it has risen from the seed. The plants are disposed in re-

gular rows, three or four feet distant from each other. Care is taken to weed them often, and the principal stalk is several times *topped*, till greenish blue spots indicate to the cultivator the maturity of the leaves. They begin to gather them in the fourth month, and this first gathering generally terminates in the space of a few days. It would be better to pluck the leaves only as they dry. In good years, the cultivators cut the plant when it is only four feet high; and the shoot, which springs from the root, throws out new leaves with such rapidity, that they may be gathered on the thirteenth or fourteenth day. These last have the cellular texture very much extended; and they contain more water, more albumen, and less of that acrid, volatile principle, which is but little soluble in water, and in which the stimulant property of tobacco seems to reside.

The preparation which the tobacco, after being gathered, undergoes at Cumanacoa, is what the Spaniards call *cura seca*. Monsieur de Pons has very well described it, as it is practised at Uritucu, and in the valleys of Aragua *. The leaves are suspended by threads of cocuiza †: their ribs are taken out, and they are twisted into cords. The prepared tobacco

* Voyage à la Terre-Ferme, vol. ii, p. 300 to 306.

† Agave americana.

should be carried to the king's warehouses in the month of June: but the laziness of the inhabitants, and the preference they give to the cultivation of maize and cassava, commonly prevent them from finishing the preparation before the month of August. It is easy to conceive, that the leaves, so long exposed to very moist air, must lose some of their flavour. The administrator of the farm keeps the tobacco deposited in the king's warehouses sixty days, without touching it. When this time is expired, the *manoques* are opened to examine the quality. If the administrator find the tobacco well prepared, he pays the cultivator three piastres for the arroba of twenty-five pounds weight. The same quantity is resold for the king's profit at twelve piastres and a half. The tobacco that is rotten *(podrido)*, that is, again in fermentation, is publickly burnt; and the cultivator, who has received money in advance from the royal farm, loses irrevocably the fruits of a long labour. We saw heaps of five hundred arrobas burnt in the great square, which in Europe might have served for making snuff.

The soil of Cumanacoa is so proper for this branch of culture, that tobacco grows wild, wherever the seed finds any moisture. It grows thus spontaneously at Cerro del Cuchivano, and around the cavern of Caripe. Besides, the only kind of tobacco cultivated at Cumanacoa, as

well as in the neighbouring districts of Aricagua and San Lorenzo, is the tobacco with large sessile leaves*, called Virginiã Tobacco. The tobacco with petiolate leaves†, which is the ỹetl of the ancient Mexicans‡, is unknown, though it is designated in Germany under the singular name of *Turkish tobacco.*

If the culture of tobacco were free, the Province of Cumana might furnish a great part of Europe. It even appears, that other districts would not be less favorable to this branch of colonial industry, than the valley of Cumanacoa, in which the too great frequency of rains often injures the aromatic property of the leaves. The growth being now confined to the space of a few square leagues, the whole produce of the harvest is only 6000 arrobas §. Nevertheless, the two provinces of Cumana and Barcelona consume 12,000. What is wanting is furnished by Spanish Guyana. There are in general only fifteen hundred persons employed in the tobacco harvest in the neighbourhood of Cumanacoa,

* Nicotiana tabacum.

† Nicotiana rustica.

‡ Political Essay on New Spain, T. 2, p. 444. In the Crimea, the cultivation of the nicotiana paniculata is preferred. Pallas, Reise in die sudl. Stadthalterschaften, vol. 2, p. 397.

§ The harvest of 1798 was 3800 arrobas: that of 1799 amounted to 6100.

and these are all whites. The hope of gain seldom stimulates the natives of the Chayma race to engage in this culture, and the administration does not deem it prudent, to furnish them with advances.

In studying the history of our cultivated plants, we are surprised to see, that before the conquest the use of tobacco was spread through the greater part of America, while the potato was unknown both in Mexico and the West India Islands, where it grows well in the mountainous regions. Tobacco has also been cultivated in Portugal ever since the year 1559, though the potato did not become an object of European agriculture till the end of the 17th and beginning of the 18th century. This latter plant, which has had such a powerful influence on the well-being of society, has spread in both continents with more slowness, than a production which can be considered only as a simple article of luxury.

Next to tobacco, the most important culture of the valley of Cumanacoa is that of indigo. The indigo manufacturers of Cumanacoa, of San Fernando, and of Arenas, produce indigo of greater commercial value than that of Carraccas; and which often nearly equals in splendor and richness of colour the indigo of Guatimala. It was from this province, that the coasts of Cumana received the first seeds of the indi-

gofera anil *, which is cultivated jointly with the indigofera tinctoria. The rains being very frequent in the valley of Cumanacoa, a plant of four feet high yields no more colouring matter, than one of a third part this size in the arid valleys of Aragua, to the west of the town of Caraccas.

The manufactories we examined are all built on the same principles. Two steeping vessels, or vats, which receive the plants intended to be brought into a state of fermentatiou, are joined together. Each of them is fifteen feet square, and two and a half deep. From these upper vats the liquor runs into beaters, between which is placed the water-mill. The axle-tree of the great wheel crosses the two beaters. It is furnished with ladles, fixed to long handles, adapted for the beating. From a spacious settling-vat, the colouring fecula is carried to the drying place†, and spread on planks of brasiletto, which, having small wheels, can be sheltered under a roof in case of sudden rains. These sloping and very low roofs give the drying place the appearance of a hot-house at some distance.

* The indigo found in commerce is produced by four species of plants: the indigofera tinctoria, i. anil, i. argentea, and i. disperma. At the Rio Negro, near the frontiers of Brasil, we found the i. argentea growing wild, but only in places anciently inhabited by Indians.

† Officinas para secar el anil.

I will not here enter into farther details on the fabrication of the colonial productions. I suppose the reader acquainted with the theory of the chemical arts, and shall therefore confine myself to observations, which may throw light on questions that have been less discussed. In the valley of Cumanacoa, the fermentation of the plant is produced with astonishing rapidity. It lasts in general but four or five hours. This short duration can be attributed only to the humidity of the climate, and the absence of the sun during the unfolding of the plant. I think I have observed, in the course of my travels, that the drier the climate is, the slower the vat works; and the greater is the quantity of indigo, at the minimum of oxidation, contained in the stalks. In the province of Caraccas, where 562 cubic feet of the plant slightly piled up yield 35 or 40 pounds of dry indigo, the liquid does not pass into the beater till after 20, 30, or 35 hours. It is probable, that the inhabitants of Cumanacoa would extract more colouring matter from the plant employed, if they left it longer steeping in the first vat*. During my abode at Cumana I made solutions of the indigo of Cumanacoa, some-

* The planters are pretty generally of opinion, that the fermentation should never continue less than ten hours. Beauvais Raseau, Art de l'Indigotier, p. 81.

what heavy and coppery, and that of Caraccas, in sulphuric acid, in order to compare them: and the solution of the former appeared to me of a much more intense blue.

Notwithstanding the excellence of the productions, and the fertility of the soil, the agricultural industry of Cumanacoa is yet in it's first infancy. Arenas, San Fernando, and Cumanacoa, bring into commerce only three thousand pounds weight of indigo, the value of which in the country is 4500 piastres. Hands are wanting, and the feeble population is daily diminishing by emigrations to the *Llanos.* These immense plains yield abundant nourishment to man, on account of the easy multiplication of cattle, while the cultivation of indigo and tobacco demand particular care. The produce of this latter branch of industry, too, is uncertain, depending on the wintry season being more or less prolonged. The labourers are dependent also on the royal administration, which furnishes pecuniary advances; and here, as in Virginia * and Georgia, the culture of alimentary plants is preferred to that of tobacco. It had been recently proposed to the government, to purchase, at the King's expense, four hundred negroes; and to distribute them among the planters, who would be able to return the advance of the purchase in two or three years.

* Jefferson, Notes on Virginia, p. 306 and 388.

By these means, it was computed, the yearly harvest of tobacco would amount to 15,000 arrobas. I observed with pleasure, that this project was blamed by several proprietors. It could not be hoped, that, following the example of some parts of the United States, liberty would be granted to the negroes or their descendants, after a certain number of years. It might indeed well be considered as dangerous, since the fatal events of St. Domingo, to increase the number of slaves on the continent. A prudent policy produces often the same effects as the nobler and less common sentiments of justice and humanity.

The plain of Cumanacoa, spotted with farms, and small plantations of indigo and tobacco, is surrounded with mountains, which rise toward the South, and are doubly interesting to the natural philosopher and the geologist. Every thing indicates, that the valley is the bottom of an ancient lake. The mountains, which in old times formed it's shores, are all perpendicular toward the plain. The outlet for the waters of the lake was only on the side of Arenas. In digging foundations, beds of round pebbles, mixed with small bivalve shells, are found; and according to the report of several persons well worthy of credit, there were discovered thirty years ago*, at the bottom of

† This discovery was made by Don Alexandro Mexias, corregidor of Catuaro.

the ravine of San Juanillo, two enormous femoral bones, four feet long, which weighed more than thirty pounds. The Indians imagined, as the common people of Europe still do, that these were giants' bones; while the half-learned sages of the country, who assume the right of explaining every thing, gravely asserted, that they were sports of nature, little worthy of attention. They founded their opinion on the circumstance, that human bones decay rapidly in the soil of Cumanacoa. In order to decorate their churches on the festival of the dead, they take skulls from the cemeteries on the coast, where the earth is impregnated with saline substances. These pretended thigh-bones of giants were carried to the Port of Cumana, where I sought for them in vain; but from the analogy of some fossil bones, which I brought from other parts of South America, and which have been carefully examined by Mr. Cuvier *, it is probable, that the gigantic femoral bones of Cumanacoa belonged to elephants of a species now lost. It may appear surprising, that they were found in a place so little elevated above the actual level of the waters; since it is a remarkable fact, that the fragments of the mastodontes and fossil elephants, which I brought from the equinoctial regions of Mexico, New

* Recherches sur les Ossemens fossiles, T. 2 (Eléphans fossiles), p. 57.

Grenada, Quito, and Peru, are not to be found in low regions; as the megatherium of Rio Luxan * and Virginia †, the great mastodontes of the Ohio, and the fossil elephants of the Susquehana, in the temperate zone; but on table-lands having from six to fourteen hundred toises of elevation.

As we approached the Southern bank of the basin of Cumanacoa, we enjoyed the view of Tumiriquiri ‡. An enormous wall of rocks, the remains of an ancient cliff, rises in the midst of

* At the distance of one league South-east of the town of Buenos Ayres.

† The megatherium of Virginia is the megalonyx of Mr. Jefferson. All the enormous remains found in the plains of the new continent, either North or South of the equator, do not belong to the torrid but to the temperate zone. On the other hand Pallas observes, that in Siberia, consequently also beyond the tropics, fossil bones are never found in mountainous parts. (Nov. Comment. Petrop., 1772, p. 577.) These facts, intimately connected together, appear to lead toward the discovery of a great geological law.

‡ Some of the inhabitants pronounce Tumuriquirí, others Turumiquiri, or Tumiriquiri. During all our stay at Cumanacoa, the summit of this mountain was covered with clouds. It appeared uncovered the 11th of September in the evening, but only for a few minutes. The angle of elevation, taken from the great square of Cumanacoa, was 8° 2′. This determination, and the barometrical measurement, which I made on the 13th, may enable us to fix, within a certain approximation, the distance of the mountain at 6 miles $\frac{1}{5}$, or 6050 toises; admitting that the part uncovered by clouds was 850 toises above the plain of Cumanacoa.

the forests. Farther to the West, at Cerro del Cuchivano, the chain of mountains seems as if broken by the effects of an earthquake. The crevice is more than a hundred and fifty toises wide, is surrounded by perpendicular rocks, and is filled with trees, the interwoven branches of which find no room to spread. The crevice appears like a mine opened by the falling in of the earth. A torrent, the Rio Juagua, traverses this crevice, the appearance of which is highly picturesque, and which is called Risco del Cuchivano. The river rises at the distance of seven leagues to the South-west, at the foot of the mountain of the Brigantine, and forms some beautiful cascades, before it spreads through the plain of Cumanacoa.

We visited several times a small farm, the Conuco of Bermudez, opposite the crevice of Cuchivano, where tobacco, plantains, and several species of cotton-trees *, are cultivated in the moist grounds; especially that tree, the cotton of which is of a nankeen colour, and which is so common in the island of Margaretta †. The proprietor of the farm told us that the crevice was inhabited by jaguar tigers. These

* Gossipium uniglandulosum, improperly called herbaceum, and g. barbadense. Mr. de Rohr has shown how much confusion still prevails in the determination of the varieties and species of the cotton-tree.

† G. religiosum.

animals pass the day in caverns, and rove around the habitations at night. Being well fed, they reach six feet in length. One of them had devoured the preceding year a horse belonging to the farm. He dragged his prey on a fine moon-light night, across the savannah, under a ceiba * of an enormous size. The groans of the dying horse awoke the slaves of the farm, who went out armed with lances, and *machetes* †. The tiger continued on his prey, awaited their approach with tranquillity, and fell only after a long and obstinate resistance. This fact, and a great many others verified on the spot, prove, that the great jaguar ‡ of Terra Firma, like the jaguarete of Paraguay, and the real tiger of Asia, does not flee from man, when it is dared to close fight, and when it is not frightened by the number of assailants. Naturalists at present admit, that Buffon was entirely mis-

* Bombax ceiba, five-leaved silk-cotton tree.

† Great knives, with very long blades, like a couteau de chasse. No one enters the woods in the torrid zone, without being armed with a *machete*, not only to cut his way through the woods, but as a defence against wild beasts.

‡ Felis onca, Lin., which Buffon called *panthère oillée*, and which he believed came from Africa. The female panther, figured in the Histoire des Quadrupèdes of Buffon, T. 9, pl. 12, is a real jaguar. (Cuvier, Ossem. fossiles, Tom. IV, Chats, p. 13.) We shall have occasion to examine hereafter a fact so important with respect to zoology, and the geography of animals.

taken with respect to the greatest of the feline race of America. What this celebrated writer says of the cowardice of the tigers of the new continent, relates to the small ocelots *; and we shall see shortly, that, at the Oronoko, the real jaguar of America sometimes leaps into the water, to attack the Indians in their canoes.

Opposite the cavern of Bermudez, two spacious caverns open into the crevice of Cuchivano, from which at times flames rush out, that may be seen at a great distance in the night. The adjacent mountains are illuminated by them; and, judging by the elevation of the rocks, above which these fiery exhalations ascend, we should be led to think, that they rise several hundred feet. This phenomenon was accompanied by a subterraneous, dull, and long continued noise, at the time of the last great earthquake of Cumana †. It is observed chiefly during the rainy season; and the owners of the farms opposite the mountain of Cuchivano assert, that the flames are become more frequent since December 1797.

In vain we attempted, in an herbalization we made at Rinconada, to penetrate into the crevice, wishing to examine the rocks, that seemed to contain in their bosom the cause of these ex-

* Felis pardalis, Lin., or chibiguazu of Azzara, different from the tlateo-ocelotl, or tiger-cat of the Azteques.

† See vol. ii. p. 217.

traordinary conflagrations. The strength of vegetation, the interweaving of the lianas and thorny plants, hindered our progress. Happily the inhabitants of the valley themselves felt a warm interest in our researches, less from the fear of a volcanic explosion, than because their imagination was struck with the idea, that the Risco del Cuchivano contained a gold mine; and although we expressed our doubts of the existence of gold in a secondary limestone, they wanted to know "what the German miner thought of the richness of the vein." Since the time of Charles V, and the government of the Welsers, the Alfingers, and the Sailers, at Coro and Caraccas, the people of Terra Firma still preserve a great confidence in the Germans, with respect to all that relates to the working of mines. Wherever I passed in South America, when the place of my birth was known, I was shown samples of ore. In these colonies every Frenchman is a physician, and every German a miner.

The farmers, with the aid of their slaves, opened a path across the woods to the first fall of the Rio Juagua; and on the 10th of September, we made our excursion to the Cuchivano. On entering the crevice, we recognized the neighbourhood of tigers, by a porcupine recently embowelled, and also by the offensive smell of their excrements, not unlike those of an European cat. For greater security the Indians returned to the

farm, and brought back some dogs of a very small breed. We were assured, that in the event of meeting a jaguar in a narrow path, he springs on the dog rather than on the man. We did not proceed on the brink of the torrent, but on the slope of the rocks which overhung the water. We walked on the side of a precipice from two to three hundred feet deep, on a kind of very narrow cornice, like the road which leads from the Grindelwald along the Mettenberg to the great glacier. When the cornice was so narrow, that we could find no place for our feet, we descended into the torrent, crossed it by fording or on the shoulders of a slave, and climbed the opposite wall. These descents are very fatiguing, and it is not safe to trust to the lianas, which hang like great cords from the tops of the trees. The creeping and parasite plants cling but feebly to the branches which they embrace: the united weight of their stalks is considerable, and you run the risk of pulling down a whole mass of verdure, if, in walking on a sloping ground, you support your weight by the lianas. The farther we advanced, the thicker the vegetation became. In several places the roots of the trees had burst the calcareous rock, by inserting themselves into the clefts that separate the beds. We had some trouble to carry the plants we gathered at every step. The cannas, the helico-

nias with fine purple flowers, the costuses, and other plants of the family of the amomums, here attain eight or ten feet in height, and their fresh and tender verdure, their silky splendour, and the extraordinary developement of the parenchyma, form a striking contrast with the brown colour of the arborescent ferns, the foliage of which is so delicately shaped. The Indians made incisions with their large knives in the trunks of the trees, and fixed our attention on those beautiful red and golden yellow woods, which will one day be sought for by our turners and cabinet makers. They showed us a plant of the family of the compositæ twenty feet high, (the eupatorium lævigatum of la Marck,) the rose of Belveria *, celebrated for the brilliancy of it's purple flowers, and the dragon's-blood of this country, which is a kind of croton † not yet described, the red and astringent juice of which is employed to strengthen the gums. They recognize

* Brownea racemosa, Bredem. ined.

† Plants of families entirely different are called in the Spanish colonies of both continents *sangre de drago*; they are dracænas, pterocarpi, and crotons. Father Caulin, (Descri. Corografica, p. 25,) in speaking of resins found in the forests of Cumana, makes a just distinction between the *drago de la sierra de Unare*, which has piunate leaves, (pterocarpus draco) and the *draco de la sierra de Paria*, with entire and hairy leaves. This last is our croton sanguifluum of Cumanacoa, Caripe, and Cariaco.

the species by the smell, and more particularly by chewing the woody fibres. Two natives, to whom the same wood is given to chew, pronounce, and often without hesitation, the same name. We could avail ourselves but little of the sagacity of our guides, for how could we procure leaves, flowers, and fruits growing on trunks, the branches of which commence at fifty or sixty feet high? We were struck at finding in this hollow the bark of trees, and even the soil, covered with moss and lichens*. The cryptogamous plants are here as common as in the countries of the North. Their growth is favored by the moisture of the air, and the absence of the direct rays of the sun. Nevertheless the temperature is generally at 25° in the day, and 19° at night.

The rocks which bound the crevice are perpendicular like walls, and are of the same calcareous formation which we observed the whole way from Punta Delgada. It is here a blackish gray, of compact fracture, tending sometimes toward the sandy fracture, and crossed by small veins of white carbonated lime. In these characteristic marks we thought we discovered the *Alpine limestone* of Switzerland and the Tyrol,

* Real *musci frondosi.* We also found, beside a small boletus stipitatus, of a snow white colour, the boletus igniarius, and the lycoperdon stellatum of Europe. I had found this last only in very dry places in Germany and Poland.

of which the colour is always very deep, though in a less degree than that of the transition limestone*. The first of these formations constitutes the Cuchivano, the nucleus of the *Impossible,* and in general the whole group of the mountains of New Andalusia. I saw no petrifactions in it; but the inhabitants assert, that considerable masses of shells are found at great heights. The same phenomenon occurs in the country about Saltzburg †. At the Cuchivano the alpine limestone contains beds of marly clay ‡, three or four toises thick; and this geological fact proves on the one hand the identity of the alpenkalkstein with the zechstein of Thuringia, and on the other the affinity of formation existing between the alpine limestone and that of Jura §. The strata of marl effervesce with

* Escher, in the Alpina, Vol. 4, p. 340.

† In Switzerland, the solitary beds of shells, at the height of from 1300 to 2000 toises, in the Jungfrauhorn, the Dent de Morcle, and the Dent du Midi, belong to transition limestone.

‡ Mergelschiefer.

§ The Jura and the Alpine limestone are kindred formations, and sometimes difficult to distinguish, where they lie immediately one upon another, as in the Apennines. The alpine limestone and the zechstein, famous among the geologists of Freiberg, are *identical* formations. This identity, which I noticed in the year 1793, (Ueber die Grubenwetter) is a geological fact so much the more interesting, as it seems to unite the northern European formations to those of the central chain. It is known, that the zechstein is situate between the muriatiferous gypsum and the conglomerate (ancient sandstone); or

acids, though silex and alumine predominate in them: they are strongly impregnated with carbon, and sometimes blacken the hands, like a real vitriolic schistus. The pretended gold mine of Cuchivano, which was the object of our examination, is nothing but an excavation cut into one of those black strata of marl, which contain pyrites in abundance. The excavation is on the right bank of the river Juagua; and must be approached with caution, because the torrent there is more than eight feet deep. The sulphurous pyrites are found, some massive, and

where there is no muriatiferous gypsum, between the slaty sandstone with roestones (bunte sandstein, Wern.), and the conglomerate or ancient sandstone. It contains strata of schistous and coppery marl (*bituminoce mergel* and *kupferschiefer*) which form an important object in the working of mines at Mansfeld, in Saxony, near Riegelsdorf, in Hesse, and at Hasel and Praunitz, in Silesia. In the southern part of Bavaria, (Oberbaiern), I saw the alpine limestone, containing these same strata of schistous clay and marl, which, though thinner, whiter, and particularly more frequent, characterize the limestone of Jura. Respecting the slates of Blattenberg, in the Canton of Glaris, which some mineralogists, because of their numerous impressions of fish, have long mistaken for the cuprous slates of Mansfeld, they belong, according to Mr. Von Buch, to a real transition formation. The whole of these geological data tend to prove, that strata of marl, more or less mixed with carbon, are to be found in the limestone of Jura, in the alpine limestone, and in the transition schists. The mixture of carbon, sulphuretted iron, and copper, appears to me to augment with the *relative antiquity* of the formations.

others crystallized and disseminated in the rock; their colour, of a very clear golden yellow, does not indicate that they contain copper. They are mixed with fibrous sulphuret of iron *, and nodules of swinestone, or fetid carbonat of lime. The marly stratum crosses the torrent; and, as the water washes out metallic grains, the people imagine, on account of the brilliancy of the pyrites, that the torrent bears down gold. It is reported, that, after the great earthquake, which took place in 1765, the waters of the Juagua were so charged with gold, that "men who came from a great distance, and whose country was unknown," established washing places on the spot. They disappeared during the night, after having collected a great quantity of gold. It would be needless to show, that this is a fable. Pyrites dispersed in quartzose veins, crossing the mica-slate *, are often auriferous no doubt; but no analogous fact leads to the supposition, that the sulphuretted iron, which is found in the schistose marls of the alpine limestone, contains gold. Some direct experiments, made with acids, during my abode at Caraccas, showed, that the pyrites of Cuchivano are not auriferous. Our guides blamed my incredulity; in vain I repeated, that alum and sulphate of

* Haarkies.

† Glimmerschiefer.

iron only could be obtained from this pretended gold-mine; they continued picking up secretly every bit of pyrites they saw sparkling in the water. The more a country is unprovided with mines, the more exaggerated are the ideas of the inhabitants respecting the facility, with which riches are drawn from the bowels of the earth. How much time did we not lose during five years travels, in visiting, on the pressing invitations of our hosts, ravines, of which the pyritous strata have borne for ages the pompous names of *Minas de oro!* How often have we grieved at seeing men of all classes, magistrates, pastors of villages, grave missionaries, grinding, with inexhaustible patience, hornblende, or yellow mica, in order to extract gold from it by means of mercury! This rage for the search of mines strikes us the more in a climate, where the ground has need of being but slightly raked to produce abundant harvests.

After visiting the pyritous marls of the Rio Juagua, we continued following the course of the crevice, which stretches itself like a narrow canal overshaded by very lofty trees. We observed strata on the left bank, opposite Cerro del Cuchivano, singularly bent and twisted. This phenomenon I had often admired at the Ochsenberg *, in passing the Lake of Lucerne.

* This mountain of Switzerland is composed of transition

The calcareous beds of the Cuchivano and the neighbouring mountains keep pretty regularly the direction of N. N. E. and S. S. W. Their inclination is sometimes North, and sometimes South; most commonly they seem to precipitate themselves toward the valley of Cumanacoa; and it cannot be doubted, that the formation of the valley had an influence * on the inclination of the strata.

We had suffered great fatigue, and were quite drenched by the frequently crossing the torrent, when we reached the foot of the caverns of the Cuchivano. A wall of rock there rises perpendicularly to the height of eight hundred toises. It is seldom that in a zone, where the force of vegetation conceals every where the soil and the rocks, we behold a great mountain presenting naked strata in a perpendicular section. In the midst of this, and in a position

limestone. We find these same inflexions in the strata near Bonneville, at Nant d'Arpenaz in Savoy, and in the valley of Estaubee in the Pyrenees, (Sauss. Voy. vol. I, § 472 and 1672. Rasoumousky, Voy. minér., p. 154. Ramond. Voy. aux Pyrénées, p. 55, 100, and 280.) Another transition rock, the *grauwakke* of the Germans, (very near the English *killas*), offers the same phenomenon in Scotland. Edin. Phil. Trans. 1814, p. 80.

* The same observation may be made at the lake of Gemuenden in Austria, which I visited with Mr. de Buch, and which is one of the most picturesque situations in Europe.

unfortunately inaccessible to man, two caverns open in the form of crevices. We were assured, that they are inhabited by the same nocturnal birds, that we should soon become acquainted with in the *Cueva del Guacharo* of Caripe. Near these caverns we saw strata of schistose marl, and found with great astonishment rock-crystals enchased in beds of alpine limestone. They were hexaedral prisms, terminated with pyramids, fourteen lines long and eight thick. The crystals, perfectly transparent, were solitary, and often three or four toises distant from each other. They were enclosed in the calcareous mass, as the quartz crystals of Burgtonna *, and the boracite of Lunebourg, are contained in gypsum. There was no crevice near, or any vestige of calcareous spar †.

We reposed ourselves at the foot of the cavern, whence those flames were seen to issue, which of late years are become more frequent. Our guides and the farmer, an intelligent man,

* In the duchy of Gotha.

† This phenomenon reminds us of another equally rare, the quartz crystals that Mr. Freiesleben (Kupferschiefer, T. 2, p. 89) found in Saxony, near Burgœrner, in the *county of Mansfeld*, in the middle of a rock of porous limestone (*rauchwakke*), lying immediately on the alpine limestone. The rock crystals, which are pretty common in the primitive limestone of Carrara, line the insides of cavities in the rocks, without being enveloped by the rock itself.

equally acquainted with the localities of the province, discussed in the manner of the creoles the dangers, to which the town of Cumanacoa would be exposed, if the Cuchivano became an active volcano; *se veniesse a reventar*. It appeared to them evident, that since the great earthquakes of Quito and Cumana, in 1797, New Andalusia was every day more and more undermined by subterranean fires. They cited the flames, which had been seen to issue from the earth at Cumana; and the shocks felt in places, where heretofore the ground had never been shaken. They recollected, that at Macarapan sulphurous emanations had been frequently perceived for some months past. We were struck with these facts, upon which were founded predictions, that have since been almost all realised. Enormous convulsions of the earth took place at Caraccas in 1812; and proved how tumultuously nature is agitated in the North-east part of Terra Firma.

But what is the cause of the luminous phenomena, which are observed in the Cuchivano? I know, that the column of air, that rises from the mouth of a burning volcano*, is sometimes

* We must not confound this very rare phenomenon with the glimmering commonly observed a few toises above the brink of a crater; and which (as I remarked at Mount Vesuvius, in 1805) is only the reflexion of great masses of inflamed scoria, thrown up without sufficient force to pass the mouth of the volcano.

seen to shine with a splendid light. Such a light, which is believed to be owing to the hydrogen gas, was observed from Chillo on the top of Cotopaxi, at a time when the mountain seemed in the greatest repose. I am aware that, according to the report of the ancients, the Mons Albanus, near Rome, known at present under the name of Monte Cavo, appeared at times on fire during the night; but the Mons Albanus is a volcano recently extinguished, which, in the time of Cato, threw out rapilli *; while the Cuchivano is a calcareous mountain, and without any trap formation near. Can these flames be attributed to the decomposition of water, entering into contact with the pyrites dispersed through the schistose marl? Is it inflamed hydrogen, that issues from the cavern of Cuchivano? The marls, as the smell indicates, are pyritous, and bituminous at the same time; and the petroleum springs at the Buen Pastor, and in the Island of Trinidad, proceed probably from these same beds of alpine limestone. It would be easy to suppose some connexion between the waters filtering through this calcareous stone, and decomposed by pyrites, and the earthquakes of Cumana, the springs of sulphuretted hydrogen in New Bar-

* Albano monte biduum continenter lapidibus pluit. Livy, lib, xxv, cap. 7. (Heyne, Opuscula acad., T. iii, p. 261).

celona, the beds of native sulphur at Carupano, and the emanations of sulphurous acid, which are perceived at times in the savannahs. It cannot be doubted also, that the decomposition of water by the pyrites at an elevated temperature, favoured by the affinity of oxidated iron for earthy substances, may have caused that disengagement of hydrogen gas, to the action of which several modern geologists have attributed so much importance. But in general, sulphurous acid is perceived more commonly in the eruption of volcanoes, than hydrogen is; and it is principally the odour of this acid, that prevails while the earth is agitated by violent shocks. When we take a general view of the phenomena of volcanoes and earthquakes, when we recollect the enormous distance at which the commotion is propagated below the basin of the sea, we readily lay aside explanations, that are founded on small strata of pyrites and bituminous marls. I am of opinion, that the shocks so frequently felt in the province of Cumana are as little to be attributed to the rocks above the surface of the earth, as those which agitate the Apennines are to asphaltic veins, or springs of burning petroleum. The whole of these phenomena depend on more general, I would almost say, on *deeper causes*; and it is not in the secondary strata, which form the exterior crust of our globe, but in the primitive

rocks, at an enormous distance from the soil, that we should place the focus of volcanic action. The greater progress we make in geology, the more we feel the insufficiency of theories, founded on observations merely local.

Meridian heights of the *Southern Fish*, observed in the night of the 7th of September, gave 10° 16′ 11″ for the latitude of Cumanacoa; the error in the most esteemed maps is consequently a quarter of a degree. The dip of the magnetic needle was 42·6°; and the intensity of the magnetic force corresponded to 228 oscillations in 10 minutes time; being consequently 9 oscillations, or 1·25, less than at Ferrol.

On the 12th we continued our journey to the convent of Caripe, the principal place of the Chayma Missions. We chose, instead of the direct road, that by the mountains of Cocollar * and Turimiquiri, the height of which little exceeds that of Jura. The road first runs toward the East, crossing during three leagues the table-land of Cumanacoa, in a soil formerly levelled by the waters, and then turns toward the South. We passed the little Indian village of

* Is this name of Indian origin? At Cumana they derive it in a manner somewhat farfetched from the Spanish word *cogollo*, signifying the heart of oleraceous plants; the Cocollar forming the centre of the whole group of the mountains of New Andalusia.

Aricagua, surrounded by woody hills and of a cheerful aspect. Thence we began to ascend, and the ascent lasted more than four hours. This part of the road is very fatiguing. We crossed the river of Pututucuar, a rapid torrent, full of blocks of calcareous rocks, two and twenty times. When on the Cuesta de Cocollar we reached an elevation two thousand feet above the level of the sea, we were surprised to find scarcely any forests or great trees. We passed over an immense plain covered with gramineous plants. Mimosas with hemispheric tops, and stems only four or five feet high, alone interrupt the dull uniformity of the savannahs. Their branches are bent toward the ground, or spread out like umbrellas. Wherever there are steep declivities, or masses of rocks half covered with mould, the clusia, or cupey with great nymphæa flowers, displays it's beautiful verdure. The roots of this tree are eight inches in diameter, and sometimes shoot out from the trunk at the height of five feet above the soil.

After having for a long time continued to climb the mountain, we reached a small plain, at the *Hato del Cocollar*. This is a solitary farm, situate on a table-land, which is 408 toises high. We rested ourselves three days in this retreat, where we were received with great kindness by the proprietor *, who had accompa-

* Don Mathias Yturburi, a native of Biscay.

nied us from the port of Cumana. We there found milk, excellent meat from the richness of the pasture, and above all, a delightful climate. During the day the centigrade thermometer * did not rise above 22° or 23°; a little before sunset it fell to 19°, and at night it scarcely kept up to 14° †. The nightly temperature was consequently seven degrees colder than that of the coasts, which is a fresh proof of an extremely rapid decrement of heat, the table-land of Cocollar being less elevated than the site of the town of Caraccas.

As far as the eye could reach, we perceived only naked savannahs from this elevated point. Small tufts of scattered trees rise in the ravines; and notwithstanding the apparent uniformity of vegetation, we found here a great number of curious plants ‡. We shall only speak of a

* At five in the afternoon, with a clear sky Reaumur's therm. was at 15°; De Luc's hyg. 62°. At 9 at night, therm. 13°; hyg. 75°. 11 at night, therm. 11·2°; hyg. 80°. At 22 h. [10 in the morning] therm. 18°; hyg. 51°. At noon, therm. 19°; hyg. 50°. We never saw the hygrometer lower than 46° (83° Saus.), notwithstanding the elevation of the place; but the rainy season had begun, and at this time the air, though very blue and transparent, was already excessively loaded with vapours.

† 11·2° Reaum.

‡ Cassia acuta, andromeda rigida, casearia hypericifolia, myrtus longifolia, buettneria salicifolia, glycine picta, g. pratensis, g. gibba, oxalis umbrosa, malpighia caripensis, ce-

superb lobelia * with purple flowers; the brownea coccinea, which is upwards of a hundred feet high; and above all, the pejoa, celebrated in the country on account of the delightful and aromatic perfume emitted by it's leaves when rubbed between the fingers †. But what charmed us the most in this solitary place was the beauty and serenity of the nights. The proprietor of the farm prolonged his evenings with us; he seemed to enjoy the astonishment produced on Europeans newly transplanted to the tropics by that freshness of the air like spring, which is felt on the mountains after sunset. In those distant climates, where men yet feel the full value of the gifts of nature, a

phælis salicifolia, stylosanthes angustifolia, salvia pseudococcinea, eryngium fætidum. We found a second time this last plant, but at a considerable height, in the great forests of bark-trees, surrounding the town of Loxa, in the centre of the Cordilleras.

* Lobelia spectabilis.

† It is the gualtheria odorata, described by Mr. Willdenouw (Neue Schriften der. Nat. Freunde, T, 4, p. 218), from specimens that we had given him. The pejoa is found round the lake of Cocollar, which gives birth to the great river Guarapiche. We met with the same shrub at the *Cuchilla de Guanaguana*. It is a subalpine plant, which, as we shall see very soon, forms at the *Silla de Caraccas* a zone much higher than in the province of Cumana. The leaves of the pejoa have a more agreeable smell even than those of the myrtus pimenta, but they yield no perfume when rubbed a few hours after their separation from the tree.

landholder boasts of the water of his spring, the absence of noxious insects, the salutary breeze that blows round his hill, as we descant in Europe on the conveniencies of our dwellings, and the picturesque effect of our plantations.

Our host had visited the new world with an expedition, which was to form establishments for cutting wood for the Spanish navy on the shores of the gulf of Paria. In these vast forests of mahogany, cedar, and brasil-wood, which border the sea of the West Indies, they reckoned on choosing the trunks of the largest trees, giving them in a rough way the shape adapted to the building of ships, and sending them every year to the dock-yard of the Caraccas, near Cadiz. White men, unaccustomed to the climate, could not support the fatigue of labour, the heat, and the effect of the noxious air exhaled by the forests. The same winds that are loaded with the perfume of flowers, leaves, and woods, infuse also, as we may say, the germes of dissolution into the vital organs. Destructive fevers carried off not only the ship-carpenters, but the persons who had the management of the establishment: and this bay, which the first Spaniards named *Golfo Tristo*, *Melancholy Bay*, on account of the mournful and savage aspect of it's coasts, became the grave of European seamen. Our host had the rare good fortune to escape these dangers. Af-

ter having witnessed the death of a great number of his friends, he withdrew far from the coasts to the mountains of Cocollar. Without neighbours, the quiet possessor of five leagues of savannahs, he enjoyed at once that independence, which belongs to solitude, and that serenity of mind, which a pure and bracing air produces in men who live agreeably to the simplicity of nature.

Nothing can be compared to the impression of majestic tranquillity, which the aspect of the firmament inspires in this solitary region. Following with the eye, at the entrance of the night, those meadows that bound the horizon, that plain covered with verdure, and gently undulated, we thought we saw from afar, as in the deserts of the Oronoko, the surface of the ocean supporting the starry vault of Heaven. The tree under which we were seated, the luminous insects flying in the air, the constellations that shone toward the south; every object seemed to tell us, that we were far from our native soil. If amid this exotic nature the bell of a cow, or the roaring of a bull, were heard from the depth of a valley, the remembrance of our country was awakened suddenly in the sound. They were like distant voices resounding from beyond the ocean, and with magical power transporting us from one hemisphere to the other. Strange

mobility of the imagination of man, eternal source of our enjoyments, and our pains!

We began in the cool of the morning to climb the Tumiriquiri. Thus is called the summit of the Cocollar, which, with the Brigantine, forms one single mass of mountain, formerly called by the natives the *Sierra de los Tageres*. We travelled along a part of the road on horses, which roam about these savannahs; but some of them are used to the saddle. Though their appearance is very heavy, they pass lightly over the most slippery turf. We first stopped at a spring, that issues not from the calcareous rock, but from a layer of quartzose sandstone *. The temperature was 21°, consequently 1·5° less than the spring of Quetepe; hence the difference of the level is nearly 220 toises. Wherever the sandstone appears above ground the soil is level, and constitutes as it were small platforms, which follow like steps. To the height of 700 toises, and even beyond, this mountain, like those in it's vicinity, is covered only with gramineous plants †. This failure of trees is attributed at Cumana to the great elevation of the ground; but a slight reflection on the distribution of plants in the Cordilleras of the torrid zone will

* Direction: hor. 4·3. Dip 45° south-east.

† The most abundant species are the paspalus; the andropogon fastigiatum, which forms the genus diectomis of Mr. Palissot de Beauvois; and the panicum olyroides.

lead us to conceive, that the summits of New Andalusia are very far from reaching the superior limit of the trees, which in this latitude is at least 1800 toises of absolute height. The smooth turf of the Cocollar begins to appear at 350 toises above the level of the sea, and the traveller may contrive to walk upon this turf, till he reaches a thousand toises of height. Farther on, beyond this band covered with gramineous plants, we found, amidst peaks almost inaccessible to man, a small forest of cedrela, javillo *, and mahogany. These local circumstances induce me to think, that the mountainous savannahs of the Cocollar and Turimiquiri owe their existence only to the destructive custom the natives have of setting fire to the woods, which they want to convert into pasturage. Thus, where during three centuries grasses and alpine plants have covered the soil with a thick carpet, the seeds of trees can no longer germinate and fix themselves in the earth, though the

* Hura crepitans, of the family of the euphorbiums. The growth of it's trunk is so enormous, that Mr. Bonpland measured vats of javillo wood, 14 feet long, and 8 wide. These vats, made out of one log of wood, are employed to keep the guarapo, or juice of the sugar-cane, and the melasses. The seeds of javillo are a very active poison, and the milk that issues from the petioles when broken frequently produced inflammation in our eyes, if by chance the least quantity penetrated between the eyelids.

birds and winds waft them continually from the distant forests into the savannahs.

The climate of these mountains is so mild, that at the farm of Cocollar the cotton and coffee-tree, and even the sugar-cane, are cultivated with success. Whatever the inhabitants of the coasts may allege, hoar frost has never been found in the latitude of 10°, on heights scarcely exceeding those of the Mount D'Or, or the Puy de Dome. The pastures of Tumiriquiri become less rich in proportion to the elevation. Wherever scattered rocks afford shade, lichens and some European mosses are found. The melastoma guacito *, and a shrub, the large and tough leaves of which rustle like parchment † when shaken by the winds, rise here and there in the savannah. But the principal ornament of the turf of these mountains is a liliaceous plant with golden flowers, the marica martinicensis. It is generally observed in the province of Cumana, and Caraccas, only at four or five hundred toises of elevation ‡. The whole rocky mass of the Turimiquiri is composed of an al-

* Melastoma xanthostachyum, called *guacito* at Caraccas.

† Paliscourea rigida, *chaparro bovo.* In the savannahs, or *llanos,* the same Castillian name is given to a tree of the family of the proteaceæ.

‡ For example, in the Montanna de Avila, in the road from Caraccas to La Guayra, and in the Silla de Caraccas. The seeds of the marica are ripe at the end of December.

pine limestone, like that of Cumanacoa, and a pretty thin strata of marl and quartzose sandstone. The limestone contains masses of brown oxidated iron, and carbonat of iron. I have observed in several places, and very distinctly, that the sandstone not only reposes on the limestone, but that this last rock frequently includes and alternates with the sandstone.

We distinguished clearly the round summit of the Turimiquiri, and the lofty peaks or *Cucuruchos*, covered with a thick vegetation, and inhabited by tigers, which are hunted on account of their size, and the beauty of their skin. This round summit, which is covered with turf, is 707 toises above the level of the ocean. A ridge of steep rocks stretches out toward the West, and is interrupted at the distance of a mile by an enormous crevice, that descends toward the gulf of Cariaco. At the point where we might suppose the continuation of the ridge, two calcareous paps or peaks arise, the northernmost of which is the most elevated. It is this last which is more particularly called the *Cucurucho de Turimiquiri*, and which is considered as higher than the mountain of the Brigantine*,

* This popular opinion on the height of the Brigantine favors the supposition, that the distance from the port of Cumana to the mountain is much less than twenty-four nautical miles. For we have seen already (vol. ii, p. 206), that the angles of elevation measured at Cumana give 1255

so well known by the sailors who frequent the coasts of Cumana. We measured by angles of elevation, and a basis, rather short, traced on the round summit bare of trees, the peak, or *Cucurucho*, which was about 350 toises higher than our station, so that it's absolute height exceeded 1050 toises.

The view we enjoyed on the Turimiquiri is of

toises for the height of the Brigantine, if we admit the exactness of the distance indicated in the map of the *Deposito hydrografico* at Madrid. I find, that to make the observed angle agree with a supposed elevation of a thousand toises, the summit of the Brigantine cannot be more than nineteen miles distant from Cumana. The chain of the mountains of New Andalusia is in the same direction as the neighbouring coast, nearly from east to west; and, admitting a distance more considerable than nineteen miles, the Brigantine would be more south than the parallel of Cocollar. But the inhabitants of Cumana wanted to lay out a road to Nueva Barcelona over the Brigantine, and I did not find the latitude of this town less than 10° 6′ 52″. This circumstance confirms the result of a trigonometrical calculation made at the Salado de Cumana; while on the other side the magnetic bearing of the Brigantine, taken at the summit of the *Impossible*, gives a greater distance. This bearing would be highly important, if we were perfectly certain of the longitude of the *Impossible*, and of the variation of the needle in a place, where the sandstone is strongly impregnated with iron. It is the duty of the traveller, to declare with candour the doubts he may still entertain respecting points, the position of which is not yet sufficiently ascertained. On making land on the coast of Cumana, the pilot reckoned the distance of the Tataraqual fifteen or sixteen miles.

vast extent, and highly picturesque. From the summit to the ocean we perceived chains of mountains extended in parallel lines from east to west, and bounding longitudinal valleys. These valleys are intersected at right angles by an infinite number of small ravines, scooped out by the torrents: the result of which is, that the lateral ranges are transformed into so many rows of paps, some round, and others pyramidal. The ground in general is a gentle slope, as far as the *Impossible*; farther on, the precipices become bold, and continue so to the shore of the gulf of Cariaco. The form of this mass of mountains reminded us of the chain of the Jura; and the only plain, that presents itself, is the valley of Cumanacoa. We seemed to see the bottom of a funnel, in which we distinguished, amidst tufts of scattered trees, the Indian village of Aricagua. Toward the north, a narrow slip of land, the peninsula of Araya, formed a dark stripe on the sea, which, illumined by the rays of the sun, reflected a strong light. Beyond the peninsula the horizon was bounded by Cape Macanao, the black rocks of which rise amid the waters like an immense bastion.

The farm of Cocollar, situate at the foot of the Turimiquiri, is in lat. 19° 9′ 32″ *. I found

* From meridian altitudes of Deneb Cygni, which I took in the nights of the 12th and 13th of September. Observ. Astron., vol. i, p. 98.

the dip of the needle 42·1°. The needle oscillated 229 times in 10′. Perhaps masses of brown iron ore, included in the calcareous rock, caused a slight augmentation in the intensity of the magnetic forces. I do not give here the experiments made with an invariable pendulum; since, notwithstanding the care I took in these experiments, I think them defective, on account of the imperfect suspension of the rod of the pendulum.

On the 14th of September we descended the Cocollar, toward the Mission of San Antonio. The road led at first across savannahs strewed with large blocks of calcareous stone, and we then entered a thick forest. After having passed two ridges of mountains extremely steep *, we discovered a fine valley five or six leagues in length, pretty constantly following the direction of east and west. In this valley the Missions of San Antonio and Guanaguana are situate; the first is famous on account of a small church with two towers, built of brick, in a pretty good style, and ornamented with columns of the Doric order, the wonder of the country. The pre-

* These ridges, rather difficult to climb toward the end of the rainy season, are known under the singular names of, *Los Yepes* and *Fantasma*. The limestone, whenever it appears uncovered in these places, is directed, hor. 4–5. (Dip of the strata, 40° S. E.)

fect of the capuchins completed the building of this church in less than two summers, though he employed only the Indians of his village. The mouldings of the capital, the cornices, and a frize decorated with suns and arabesques, are executed in clay mixed with pounded brick. If we be surprised to find churches in the purest Grecian style on the confines of Lapland *, we are still more struck with these first essays of art under a zone, where every thing indicates the savage state of man, and where the basis of civilization has not been laid by the Europeans more than forty years. The governor of the province disapproved the luxury of these constructions in the Missions, and, to the great regret of the friars, the finishing of the temple has been suspended. The Indians of San Antonio are far from sharing these regrets: they secretly approve the decision of the governor, which suits their natural indolence; they care no more for ornaments of architecture, than the natives formerly did in the Missions of the Jesuits of Paraguay.

I stopped at the Mission of San Antonio only to open the barometer, and take a few altitudes of the sun. The elevation of the great square above Cumana is 216 toises. After having crossed the village, we forded the rivers Colora-

* At Skeleftør, near Torneo. Buch, Voyage en Norwège, T. II, p. 275.

do and Guarapiche, both of which, rising in the mountains of the Cocollar, blend their waters lower down toward the East. The Colorado has a very rapid current, and becomes at it's mouth broader than the Rhine. The Guarapiche, united to the Rio Areo, is more than twenty-five fathoms deep. It's banks are ornamented by a superb gramen, of which I made a drawing two years afterward on ascending the river Magdalena, and the distich-leaved stalk of which often reaches fifteen or twenty feet*. Our mules could scarcely drag themselves on through the thick mud, with which the level and narrow road were covered. The rain fell in torrents, and the whole forest seemed converted into a marsh by the force and frequency of the showers.

Toward evening we reached the Mission of Guanaguana, the soil of which is almost on a level with the village of San Antonio. We were much in need of drying our clothes. The missionary received us cordially; he was an old

* *Lata* or *cana brava*. It is a new genus, between aira and arundo, that we have described under the name of gynerium (Pl. Equin., vol. 2, p. 112). This colossal gramen looks like the donax of Italy. This, the arundinaria of the Missisippi, (ludolfia Wild., miegia of Persoon,) and the bamboos, are the highest gramens of the new continent. It's seed has been carried to St. Domingo, and it's stalk employed to thatch the Negroes' huts.

man, who seemed to govern his Indians with great intelligence. The village has existed only thirty years on the spot it now occupies. Before that time it was placed more to the South, and backed by a hill. It is astonishing with what facility the Indians are made to remove their dwellings. There are villages in South America, which in less than half a century have thrice changed their situation. The native finds himself attached by ties so feeble to the soil he inhabits, that he receives with indifference the order of taking down his house, to rebuild it elsewhere. A village changes it's situation like a camp. Wherever clay, reeds, and the leaves of the palm or heliconia are found, a house is built in a few days. These compulsory changes have often no other motive than the caprice of a missionary, who, recently arrived from Spain, fancies that the situation of the Mission is feverish, or that it is not sufficiently exposed to the winds. Whole villages have been transported several leagues, merely because the monk did not find the prospect from his house sufficiently beautiful or extensive.

Guanaguana has yet no church. The old monk, who had inhabited during thirty years the forests of America, observed to us, that the money of the community, or the produce of the labour of the Indians, ought to be employed first in the construction of the missionary's

house, next in that of the church, and lastly in the clothing of the Indians. He gravely assured us, that this order could not be changed on any pretence, and the Indians, who prefer a state of absolute nakedness to the slightest clothing, are in no hurry that their turn should come. The spacious abode of the *Padre* had just been finished; and we remarked with surprise, that this house, the roof of which formed a terrace, was ornamented with a great number of chimnies, that looked like turrets. This, our host told us, was done to remind him of a country that was dear to his recollection, and of the winters of Arragon amid the heats of the torrid zone. The Indians of Guanaguana cultivate cotton for their own benefit, as well as for that of the church and missionary. The produce is considered as belonging to the community; and it is with the money of the community, that the wants of the priest and the altar are supplied. The natives have machines of a very simple constructiou, to separate the cotton from the seeds. These are wooden cylinders of an extremely small diameter, between which the cotton passes, and which are made to turn by a treadle. These machines, however imperfect, are very useful, and begin to be imitated in other Missions. I have elsewhere explained, in my work on Mexico, how detrimental the habit of selling the cotton with the seed is with re-

spect to carriage in the Spanish colonies, where all merchandize is conveyed on the backs of mules to the sea port. The soil of Guanaguana is not less fertile than that of Aricagua, a small neighbouring village, which has also preserved it's ancient Indian name. An *almuda* of land, 1850 square toises, produces in good years from 25 to 30 fanegas of maize, each fanega weighing 100 pounds. But here, as every where else, where the beneficence of nature retards the display of industry, a very small number of acres are cleared, and the culture of alimentary plants is neglected. Scarcity of subsistence is felt, whenever the harvest of maize is lost by a protracted drought. The Indians of Guanaguana related to us as a fact not uncommon, that, the preceding year, they, their wives, and their children, had been for three months *al monte;* that is, wandering in the neighbouring forests, to live on succulent plants, palm-cabbages, fern roots, and fruits of wild trees. They did not speak of the nomade life as of a state of privation. The missionary alone felt the inconvenience; because the village had been deserted, and the members of this little community, on their return from the forests, were less docile than before.

The beautiful valley of Guanaguana stretches toward the east, opening into the plains of Punzera and Terecen. We wished to visit those

plains, and examine the springs of petroleum, which lie between the river Guarapiche and the Rio Areo: but the season of rains was already arrived, and we were in daily perplexity to dry and preserve the plants we had collected. The road from Guanaguana to the village of Punzera goes either by St. Felix or by Caycara and Guayuta, which is a *hato* (farm for cattle) of the missionaries. In this last place, according to the report of the Indians, great masses of sulphur are found, not in a gypseous or calcareous rock, but at a small depth below the soil, in a bed of clay. This singular phenomenon appears to me peculiar to America; we shall find it again in the kingdom of Quito, and in New Spain. On approaching Punzera, we saw in the savannahs small bags, formed of a tissue of silk, suspended from the branches of the lowest trees. It is the *seda silvestre*, or wild silk of the country, which is of a beautiful lustre, but very rough to the touch. The phalena which produces it is perhaps analogous with that of the provinces of Guanaxuato and Antioquia, which also furnish wild silk *. We found in the beautiful forest of Punzera two trees known by the names of curucay and canela; the first, of which we shall speak hereafter, yields a resin very much sought after by the *Piaches*, or In-

* Nouv. Esp., T. 1, p. 453; T. 3, p. 668.

dian sorcerers; the leaves of the second have the smell of the real cinnamon of Ceylon*. From Punzera the road leads by Terecen and Nueva Palencia, which was a new colony of Canarians, to the port of San Juan, situate on the right bank of the river Areo: and it is only by crossing this river in a canoe, that the traveller can arrive at the famous petroleum springs (or mineral tar) of Buen Pastor. They were described to us as small wells or funnels, hollowed out by nature in a marshy soil. This phenomenon recalled to us the lake of asphaltum, or of *chapapote*, in the island of Trinidad†, which is distant from Buen Pastor, in a straight line, only thirty-five sea leagues.

Having long combated the desire we felt to from descend the Guarapiche to the Golfo Triste, we took the direct road of the mountains. The valleys of Guanaguana and Caripe are separated by a kind of dyke, or calcareous ridge, well

* Is it the laurus cinnamomoides of Mutis? What is that other cinnamon-tree, which the Indians call *tuorco*, common in the mountains of Tocuyo, and at the sources of the Rio Uchere, the bark of which is mixed with chocolate? Father Caulin gives the name of curucay to the copaifera officinalis, which yields the balsam of capivi. (Hist. corograf., p. 24 et 34.)

† Laguna de la Brea, south-east of the port of Naparima. There is another spring of asphaltum on the eastern coast of the island, in the bay of Mayaro.

known by the name of the Cuchilla * de Guanaguana. We found this passage difficult, because at that time we had not climbed the Cordilleras; but it is by no means so dangerous as they love to represent it at Cumana. The path is indeed in several parts only fourteen or fifteen inches broad; and the ridge of the mountain, along which the road runs, is covered with a short turf extremely slippery; the slopes on each side are steep, and the traveller, if he should stumble, might slide down on the grass to the depth of seven or eight hundred feet. Nevertheless, the flanks of the mountain offer rather steep declivities than real precipices; and the mules of this country are so sure footed, that they inspire the greatest confidence. Their habits are the same as those of the beasts of burden in Switzerland and the Pyrenees. In proportion as a country is more savage, the instinct of domestic animals improves in address and sagacity. When the mules feel themselves in danger, they stop, turning their heads to the right and to the left; the motion of their ears seems to indicate, that they reflect on the decision they ought to take. Their resolution is slow, but always just, if it be free; that is to

* Ridge like "the blade of a knife." Throughout all Spanish America they give the name of *cuchilla* to the ridge of a mountain terminated on each side by very steep declivities.

say, if it be not crossed or hastened by the imprudence of the traveller. It is on the frightful roads of the Andes, during journeys of six or seven months across mountains furrowed by torrents, that the intelligence of horses and beasts of burden displays itself in an astonishing manner. Thus the mountaineers are heard to say, "I will not give you the mule whose step is the easiest, but him who reasons best;" *la mas racional.* This popular expression, dictated by long experience, combats the system of animated machines, better perhaps than all the arguments of speculative philosophy.

When we had reached the highest point of the ridge or cuchilla of Guanaguana, an interesting spectacle presented itself to our eyes. We embraced in one view the vast savannahs or meadows of Maturin and Rio Tigre *; the peak of the Tumiriquiri †; and an infinite number of parallel ridges, which, seen at a distance, looked like the waves of the sea. Toward the north-east opens the valley, that contains the convent of Caripe. The aspect of this valley is peculiarly attractive, as, shaded by forests, it forms a strong contrast with the nudity of the neighbouring mountains, which are bare of

* These natural meadows are part of the *llanos* or immense *steppes* bordered by the Oronoko.

† *El Cucurucho.*

trees, and covered with gramineous plants. We found the absolute height of the Cuchillo to be 548 toises; it is consequently 329 toises more elevated than the house of the missionary at Guanaguana.

Descending from the ridge by a winding path, we entered into a country completely woody. The soil is covered with moss, and a new species of drosera *, which by it's form reminded us of the drosera of the Alps. The thickness of the forests, and the force of vegetation, augmented as we approached the convent of Caripe. Every thing here changes it's aspect, even to the rock that accompanied us from Punte Delgada. The calcareous strata become thinner, forming graduated steps, which stretch out like walls, cornices, and turrets, as in the mountains of Jura, those of Pappenheim in Germany, and near Oizow in Gallicia. The colour of the stone is no longer of a smoky or bluish gray; it becomes white: it's fracture is smooth, and sometimes even imperfectly conchoidal. It is no longer the calcareous formation of the Higher Alps, but a formation to which this serves as a basis, and which is analogous to the Jura limestone. In the chain of the Apennines, between Rome and Nocera, I observed this same immediate superposition †. It indicates,

* Drosera tenella.

† It is thus, that near Geneva the rock of the Mole, be-

we here repeat, not the transition from one rock to another, but the geological affinity existing between two formations. According to the general type* of the secondary strata, recognised

longing to the Alpine limestone, lies under the Jura limestone, which forms Mount Saleve.

* The succession of secondary formations seems to be on the continent as follows, when they are all equally developed; that is to say, when none of them are either wanting, or involved in the neighbouring formations. 1°. Ancient sandstone, lying on transition slate (alter sandstein, todes liegende). 2°. Alpine limestone (alpenkalkstein, zechstein). 3°. Ancient gypsum (salzgyps). 4°. Jura limestone (jurakalkstein). 5°. Sandstone of the second formation, Molasse (bunter sandstein). 6°. Fibrous gypsum (neuer gyps). 7°. Limestone of the third formation (muschelkalkstein of Werner). 8°. Chalk. 9°. Limestone with cerites. 10°. Gypsum with bones. 11°. Sandstone. 12°. Fresh water formation. We shall often have occasion to recur to this type, the complete knowledge of which seems to be the principal object of geognosy, and upon which accurate ideas have been begun to be formed only within these twenty years. We shall merely observe here, that the last formations 8, 9, 10, 11, 12, examined with so much care by Brogniart and Cuvier, are wanting in a great part of Europe; that the limestones 2 and 4 often form only one mass; and that in every place, where the two formations of gypsum (3 and 6) are missing, the order of secondary rocks is reduced to the very simple type of *two sandstone formations alternating with two calcareous formations*. To account for a great number of phenomena of superposition, which appear very singular at first sight, we must recollect the two following laws, founded upon the analogy of well observed facts: 1°. When two

in a great part of Europe, the Alpine limestone is separated from the Jura limestone by the muriatiferous gypsum; but often this last is entirely wanting, or is contained as a *subordinate layer* in the Alpine limestone. In this case the two great calcareous formations succeed each other immediately, or are confounded in one mass.

The descent from the Cuchilla is far shorter than the ascent. We found the level of the valley of Caripe 200 toises higher than that of the valley of Guanaguana. A group of mountains of little breadth separates two valleys, one of which is of delicious coolness, while the other is famed for the heat of it's climate. These constrasts, so common in Mexico, New Grenada, and Peru, are very rare in the North east part of South America. Thus Caripe * is the only one of the high valleys of New Andalusia, which is well inhabited. In a province, the population

formatious succeed one another immediately, it often happens, that the strata of one begin to alternate with the strata of the other, till the newest formation appears without being mingled with subordinate strata (Buch, Geogn. Beob., Vol, 1, p. 104 and 156): 2°, When a formation of little thickness is placed, from its relative antiquity, between two great formations, we sometimes observe that it disappears entirely. or that it is involved as a subordinate stratum in one or other of the neighbouring formations.

* Absolute height of the convent, above the level of the sea, 412 toises.

of which is inconsiderable, and where the mountains offer neither a great mass, nor very extensive flats, men have few motives to forsake the plains, and settle themselves in temperate or elevated regions.

CHAPTER VII.

Convent of Caripe.—Cavern of the Guacharo.—Nocturnal Birds.

An alley of perseas led us to the Hospital of the Arragonese Capuchins. We stopped near a cross of Brasil wood, erected in the midst of a square, and surrounded with benches, on which infirm monks seat themselves to say their rosaries. The convent is backed by an enormous wall of perpendicular rocks, covered with thick vegetation. The stone, of resplendent whiteness, appears only here and there between the foliage. It is difficult to imagine a more picturesque spot. It recalled forcibly to my remembrance the valleys of Derbyshire, and the cavernous mountains of Muggendorf in Franconia. The places of the beeches and maple-trees of Europe are here occupied by the prouder forms of the ceiba, and the palm-trees, praga and irasse. Numberless springs gush out from the sides of the rocks, which encircle the basin of Caripe, and of which the abrupt slopes pre-

sent toward the South profiles of a thousand feet in height. These springs arise for the most part from a few narrow crevices. The humidity, which they spread around, favors the growth of the great trees; and the natives, who love solitary places, form their *conucos* along the sides of these crevices. Plantains and papaw trees surround tufts of arborescent fern. The mixture of wild and cultivated plants gives the place a peculiar charm. Springs are distinguished from afar, on the naked flanks of the mountains, by the tufted masses of vegetation*,

* Among the interesting plants of the valley of Caripe, we found for the first time a calidium, the trunk of which is twenty feet high (c. arboreum); the mikania micrantha, which may probably possess some of the alexipharmic properties of the famous *guaco* of the Choco; the bauhinia obtusifolia, a very large tree, called guarapa by the Indians; the weinmaunia glabra; a psychotria-tree, the capsules of which, when rubbed between the fingers, give a very agreeable orange smell; the dorstenia houstoni (*raiz de resfriado*); the martinia craniolaria, the white flowers of which are six or seven inches long; a scrofularia, that has the aspect of the verbascum miconi, and the leaves of which, all radical and hairy, are marked with silvery glands. The nacibæa or manettia of Caripe (manettia cuspidata), of which I made a drawing on the spot, is very different from the m. reclinata of Mutis. This last, which serves as a type to the genus, Linnæus places in Mexico, though it belongs to New Grenada. Mr. Mutis has never been in Mexico: and he requested us, to acquaint those who pursue the study of botany, that all the plants he sent to Upsal, and which are described

which at first sight seem suspended from the rocks, and in descending down the valley follow the sinuosities of the torrents.

We were received with great hospitality by the monks* of the hospital. The father guardian, or superior, was absent; but, having had notice of our departure from Cumana, he had provided, with the most attentive care, whatever could render our abode agreeable. The hospital has an inner court, surrounded by a portico, like the convents in Spain. This enclosed place was highly convenient for setting up our instruments, and making observations. We found a numerous society in the convent; young monks, recently arrived from Spain, were just going to be settled in the Missions; while old infirm missionaries sought for health in the fresh and salubrious air of the mountains of Caripe. I was lodged in the cell of the Superior, which contained a pretty good collection of books. I found there with surprise, near the *Teatro critico* of *Feijo*, and the *Lettres édifiantes*, the *Traité d'Electricité* by abbé Nollet. It seemed as if

in the *Species*, the *Mantissa*, and the *Supplement*, as coming from New Spain, are from the Montuosa near Pampeluna, or from the Mina del Zapo, near Ibague; consequently from the mountains of New Grenada.

* We take a pleasure in recording with gratitude the names of Fathers Manuel de Monreal, Luis de Mirabete, and Francisco de Allaga.

the progress of knowledge were felt even in the forests of America. The youngest of the capuchin monks of the last Mission * had brought with him a Spanish translation of Chaptal's Treatise on Chemistry, and intended to study this work in the solitude, where he was destined to pass the remainder of his days. I doubt whether this desire of instruction would be lasting in the mind of a young monk, isolated on the banks of the Rio Tigre: but what is certain, and highly honorable to the spirit of the age is, that, during our long abode in the Missions of South America, we never perceived any sign of intolerance. The monks of Caripe were not ignorant, that I was born in the protestant part of Germany. Authorised by the orders of the court, I had no motives to conceal from them this fact; nevertheless, no mark of distrust, no indiscreet question, no attempt at controversy, ever diminished the value of the hospitality they exercised with so much liberality and frankness. We shall examine in another place the causes and limits of this tolerance of the missionaries.

* Beside the villages where the Indians are collected together under the government of a missionary, the name of Mission is given in the Spanish Colonies to an assemblage of young monks, who depart together from a Spanish Port, to form monastic establishments either in the New World, or in the Philippine Islands. Hence the phrase; "Go to Cadiz, to seek a new Mission."

The convent is founded on a spot, which was anciently called Areocuar. It's height above the level of the sea is nearly the same as that of the town of Caraccas, or of the inhabited part of the Blue Mountains of Jamaica *. Thus the mean temperatures of these three points, all situate between the tropics, are nearly the same. The necessity of being covered during the night is felt at Caripe, especially at sunrise. We saw the centigrade thermometer, at midnight, between 16° and 17·5° †; in the morning, between 19° and 20°. About one o'clock it had risen only to 21°, or 22·5° ‡. This temperature is sufficient for the developement of the productions of the torrid zone; though, compared with the excessive heat of the plains of Cumana,

* In the district of Clarendon, the centrigade therm. remains in the day between 22° and 24°; it rises but seldom to 26·5° and sometimes falls to 18°. This region of the Blue Mountains is pretty well inhabited. Some houses are there found at elevations, where the colonists are obliged to light fires to warm them, when (as at Santa Fe de Bogota) the air is cooled in the morning down to 10°. At the same time the heat of the plain, at Kingston for example, is from 32° to 35°. See the observations of Mr. Farquhar, who lived seventeen years in Jamaica, in the Philadelphian Med. Museum, Vol. 1, p. 182. I wished to collect in my work every thing relative to the influence of heights on climates, and organized beings, as well in the West India islands as on the continent of Equinoctial America.

† Between 12·8° and 14° Reaum.

‡ Only to 16·8° or 18° Reaum.

we might call it the temperature of spring. Water, exposed to currents of air in vessels of porous clay, cools at Caripe, during the night, as low as 13°*. I need scarcely observe, that this water appears almost ice to travellers, who arrive at the convent in one day, either from the coast, or from the burning savannahs of Terezen; and who consequently are accustomed to drink the water of rivers, the temperature of which is commonly from 25° to 26° of the centigrade thermometer †.

The mean temperature of the valley of Caripe, inferred from that of the month of September, appears to be 18·5°. Under this zone, according to observations made at Cumana, the temperature of September differs hardly half a degree from that of the whole year. The mean temperature of Caripe is equal to that of June at Paris, where nevertheless the extreme heats are ten degrees above those of the hottest days in Caripe. The elevation of the convent being only four hundred toises, the rapidity of the decrement of heat from the coasts may appear surprising. The thickness of the forests prevents any reverberation from the soil, which is soft and humid, and covered with a thick matting of plants and mosses. During weather

* 10·4° Reaum.

† From 20° to 20·8° Reaum.

constantly foggy, the sun remains whole days without action; and toward the beginning of the night, fresh breezes descend from the Sierra del Guacharo into the valley.

Experience has proved, that the temperate climate and rarefied air of this spot are singularly favorable to the cultivation of the coffee-tree, which is well known to flourish on heights. The prefect of the Capuchins, an active and enlightened man, has introduced into the province this new branch of agricultural industry. Indigo was formerly planted at Caripe, but the small quantity of fecula yielded by this plant, which requires strong heats, caused the culture to be abandoned. We found in the *Conuco* of the community many culinary plants, maize, the sugar cane, and five thousand coffee-trees, which promised a fine harvest. The friars were in hopes of tripling the number in a few years. We cannot help remarking this uniform tendency, which manifests itself at the beginning of civilization, in the policy of the monastic hierarchy. Wherever convents have not yet acquired wealth, in the new continent, as formerly in Gaul, in Syria, and in the north of Europe, they exercise a happy influence on the clearing of the soil, and the introduction of exotic vegetables. At Caripe, the Conuco of the community presents the appearance of an extensive and beautiful garden. The natives are

obliged to work in it every morning from six to ten, and the alcaids and alguazils of Indian race overlook their labours. These men are the great officers of state, who alone have the right of carrying a cane, and the choice of whom depends on the superior of the convent. They attach much importance to this right. Their pedantic and silent gravity, their cold and mysterious air, their love of appearing in form at church and in the assemblies of the people, force a smile from Europeans. We were not yet accustomed to these shades of the Indian character, which we found the same at the Oronoko, in Mexico, and in Peru, among people totally different in their manners and their language. The alcaids came daily to the convent, less to treat with the monks on the affairs of the Mission, than under the pretence of inquiring after the health of the newly arrived travellers. As we gave them brandy, their visits became more frequent than the monks desired.

During the whole time we passed at Caripe, and in the other Chayma Missions, we observed, that the Indians were treated with kindness. In general the Missions of the Arragonese Capuchins appeared to us to be governed by a system of order and discipline, which unfortunately is not common in the New World. Abuses that belong to the general spirit of monastic establishments cannot be imputed to

any congregation in particular. The guardian of the convent sells the produce of the Conuco ; and, as all the Indians are employed in it's cultivation, all have an equal share in the gain. Maize, clothes, tools, and, I was assured, sometimes money, are distributed among the people. These monastic institutions resemble, as I have already observed, the establishments of the Moravian brethren. They are advantageous to the progress of a rising society; and in the catholic communities known under the name of Missions, the independence of families, and the individual existence of all the members of the society, are more respected than in the protestant communities, that follow the rules of Zinzendorf.

What gives most celebrity to the valley of Caripe, beside the extraordinary coolness of the climate, is the great *Cueva*, or Cavern of the *Guacharo* *. In a country where the people love what is marvellous, a cavern that gives

* The province of Guacharucu, which Delgado visited in 1534, in the expedition of Hieronimo de Ortal, appears to have been situate South, or South-east from Macarapana. Has it's name any connexion with those of the cavern and the bird? or is this last of Spanish origin? (Laet, Nov. Orb., p. 676). Guacharo means in Castilian "one who cries and laments himself"; now the bird of the cavern of Caripe, and the guacharaca (phasianus parraka), are very noisy birds.

birth to a river, and is inhabited by thousands of nocturnal birds, the fat of which is employed in the Missions to dress food, is an everlasting object of conversation and discussion. Scarcely has a stranger arrived at Cumana, when he is told of the stone of Araya for the eyes; of the labourer of Arenas, who suckled his child; and of the cavern of Guacharo, which is said to be several leagues in length; till he is tired of hearing of them. A lively interest in the phenomena of nature is preserved wherever society may be said to be without life; where, in dull monotony, it presents only simple relations little fitted to excite the ardour of curiosity.

The cavern, which the natives call *a mine of fat*, is not in the valley of Caripe itself, but at three short leagues distance from the convent, toward the West-south-west. It opens into a lateral valley, which terminates at the *Sierra del Guacharo*. We set out toward the Sierra on the 18th of September, accompanied by the Alcaids, or Indian magistrates, and the greater part of the monks of the Convent. A narrow path led us at first during an hour and a half toward the South, across a fine plain, covered with a beautiful turf. We then turned toward the West, along a small river, which issues from the mouth of the cavern We ascended during three quarters of an hour,

walking sometimes in the water, which was shallow, sometimes between the torrent and a wall of rocks, on a soil extremely slippery and miry. The falling down of the earth, the scattered trunks of trees over which the mules could scarcely pass, the creeping plants that covered the ground, rendered this part of the road fatiguing. We were surprised to find here, at scarcely 500 toises of elevation above the level of the sea, a cruciferous plant, raphanus pinnatus. It is well known how scarce the plants of this family are between the tropics; they display in some sort a northern form, and as such we never expected to see it on the plain of Caripe at so little an elevation. Those northern forms seem also to appear in the galium caripense, the valeriana scandens, and a sanicle not unlike the s. marilandica.

At the foot of the lofty mountain of Guacharo, we were only four hundred steps from the cavern, without yet perceiving the entrance. The torrent runs in a crevice, which has been hollowed out by the waters; and we went on under a cornice, the projection of which prevented us from seeing the sky. The path winds like the river: at the last turning we came suddenly before the immense opening of the grotto. The aspect of this spot is majestic even to the eye of a traveller accustomed to the picturesque scenes of the higher Alps. I had before this seen the

caverns of the Peak of Derbyshire, where, extended in a boat, we traversed a subterranean river, under a vault of two feet high. I had visited the beautiful grotto of Treshemienshiz, in the Carpathian mountains, the caverns of the Hartz, and those of Franconia which are vast cemeteries * of bones of tigers, hyenas, and bears, as large as our horses. Nature in every zone follows immutable laws in the distribution of rocks, in the exterior form of mountains, and even in those tumultuous changes, which the exterior crust of our planet has undergone. So great a uniformity led me to believe, that the aspect of the cavern of Caripe would differ little from what I had observed in my preceding travels. The reality far exceeded my expectations. If the configuration of the grottoes, the splendor of the stalactites, and all the phe-

* The mould, that has covered for thousands of years the soil of the caverns of Gaylenreuth and Muggendorf in Franconia, emits even now choke-damps, or gazeous mixtures of hydrogen and nitrogen, that rise to the roof of their caves. This fact is known to all those who show these caverns to travellers; and when I had the direction of the mines of the Fichtelberg, I observed it frequently in the summer time. Mr. Laugier found in the mould of Muggendorf, beside phosphate of lime, 0·10 of animal matter. (Cuvier, Recherches sur les Ossemens fossiles, T. 4. Ours, p. 14.) I was struck, during my stay at Steeben, with the ammoniacal and fetid smell produced by it, when projected on a red hot iron.

nomena of inorganic nature, present striking analogies, the majesty of equinoxial vegetation gives at the same time an individual character to the aperture of the cavern.

The Cueva del Guacharo is pierced in the vertical profile of a rock. The entrance is toward the South, and forms a vault eighty feet broad and seventy-two feet high. This elevation is but a fifth less than that of the colonnade of the Louvre. The rock, that surmounts the grotto, is covered with trees of gigantic height. The mammee-tree, and the genipa * with large and shining leaves, raise their branches vertically toward the sky; while those of the courbaril and the erythrina form, as they extend themselves, a thick vault of verdure. Plants of the family of pothos with succulent stems, oxalises, and orchideæ of a singular structure †, rise in the driest clefts of the rocks; while creeping plants, waving in the winds, are interwoven in festoons before the opening of the cavern. We distinguished in these festoons a bignonia of a violet blue, the purple dolichos, and for the first time that magnificent solandra ‡, the

* Caruto, genipa americana. The flower, at Caripe, has sometimes five, sometimes six stamens.

† A dendrobium, with a golden flower, spotted with black, three inches long.

‡ Solandra scandens. It is the gousaticha of the Chayma Indians.

orange flower of which has a fleshy tube more than four inches long. The entrance of grottoes, like the view of cascades, derive their principal charm from the situation, more or less majestic, in which they are placed, and which in some sort determines the character of the landscape. What a contrast between the Cueva of Caripe, and those caverns of the North crowned with oaks and gloomy larch-trees!

But this luxury of vegetation embellishes not only the outside of the vault, it appears even in the vestibule of the grotto. We saw with astonishment plantain-leaved heliconias eighteen feet high, the praga palm-tree, and arborescent arums, follow the banks of the river, even to those subterranean places. The vegetation continues in the cave of Caripe, as in those deep crevices of the Andes, half excluded from the light of day; and does not disappear, till, advancing in the interior, we reach thirty or forty paces from the entrance. We measured the way by means of a cord: and we went on about four hundred and thirty feet, without being obliged to light our torches. Daylight penetrates even into this region, because the grotto forms but one single channel, which keeps the same direction, from South-east to North-west. Where the light begins to fail, we heard from afar the hoarse sounds of the nocturnal birds; sounds, which the natives

think belong exclusively to those subterraneous places.

The guacharo is of the size of our fowls, has the mouth of the goatsuckers and procnias, and the port of those vultures, the crooked beak of which is surrounded with stiff silky hairs. Suppressing, with Mr. Cuvier, the order of picæ, we must refer this extraordinary bird to the passeres, the genera of which are connected with each other by almost imperceptible transitions. I have noted it under the name of steatornis, in a particular monography, contained in the second volume of my Observations on Zoology and Comparative Anatomy. It forms a new genus *, very different from the goat-sucker by the force of it's voice, by the considerable strength of it's beak, containing a double tooth, by it's feet without the membranes that unite the anterior phalanxes of the claws. It is the first example of a nocturnal bird among the *passeres dentirostrati*. In it's manners it has analogies both with the goat-suckers and the alpine crow †. The plumage of the guacharo is of a dark bluish gray, mixed with small streaks and specks of black. Large

* It's essential characters are: rostrum validum, lateribus compressum, apice aduncum, mandibula superiori subbidentata, dente anteriori acutiori. Rictus amplissimus. Pedes breves, digitis fissis, unguibus integerrimis.

† Corvus pyrrhocorax.

white spots, which have the form of a heart, and which are bordered with black, mark the head, the wings, and the tail. The eyes of the bird are hurt by the blaze of day; they are blue, and smaller than those of the goat-suckers. The spread of the wings, which are composed of seventeen or eighteen quill feathers, is three feet and a half. The guacharo quits the cavern at night-fall, especially when the moon shines. It is almost the only frugiferous nocturnal bird, that is yet known; the conformation of it's feet sufficiently shows, that it does not hunt like our owls. It feeds on very hard fruits; as the nut-cracker* and the pyrrhocorax. The latter nestles also in clefts of rocks, and is known under the name of *night-crow*. The Indians assured us, that the guacharo does not pursue either the lamellicornous insects, or those phalænæ which serve as food to the goat-suckers. It is sufficient to compare the beaks of the guacharo and goat-sucker, to conjecture how much their manners must differ. It is difficult to form an idea of the horrible noise occasioned by thousands of these birds in the dark part of the cavern, and which can only

* Corvus caryocatactes, c. glandarius. Our alpine crow builds it's nest, toward the top of Mount Libanus, in subterranean caverns, nearly like the guacharo; the horribly shrill voice of which it also has. (Labillardière, Ann. du Musée, T. 18, p. 455.)

be compared to the croaking of our crows, which, in the pine forests of the North, live in society, and construct their nests upon trees, the tops of which touch each other. The shrill and piercing cries of the guacharoes strike upon the vaults of the rocks, and are repeated by the echo in the depth of the cavern. The Indians showed us the nests of these birds, by fixing torches to the end of a long pole. These nests were fifty or sixty feet high above our heads, in holes in the shape of funnels, with which the roof of the grotto is pierced like a sieve. The noise increased as we advanced, and the birds were affrighted by the light of the torches of copal. When this noise ceased a few minutes around us, we heard at a distance the plaintive cries of the birds roosting in other ramifications of the cavern. It seemed as if these bands answered each other alternately.

The Indians enter into the Cueva del Guacharo once a year, near midsummer, armed with poles, by means of which they destroy the greater part of the nests. At this season several thousands of birds are killed; and the old ones, as if to defend their brood, hover over the heads of the Indians, uttering terrible cries. The young *, which fall to the ground, are opened on the spot. Their peritoneum is extremely

* Los pollos del Guacharo.

loaded with fat, and a layer of fat reaches from the abdomen to the anus, forming a kind of cushion between the legs of the bird. This quantity of fat in frugivorous animals, not exposed to the light, and exerting very little muscular motion, reminds us of what has been long since observed in the fattening of geese and oxen. It is well known how favourable darkness and repose are to this process. The nocturnal birds of Europe are lean, because, instead of feeding on fruits, like the guacharo, they live on the scanty produce of their prey. At the period which is commonly called at Caripe *the oil harvest* *, the Indians build huts with palm leaves, near the entrance, and even in the porch of the cavern. Of these we still saw some remains. There, with a fire of brush-wood, they melt in pots of clay the fat of the young birds just killed. This fat is known by the name of butter or oil *(manteca* or *aceite)* of the guacharo. It is half liquid, transparent, without smell, and so pure that it may be kept above a year without becoming rancid. At the convent of Caripe no other oil is used in the kitchen of the monks but that of the cavern; and we never observed, that it gave the aliments a disagreeable taste or smell.

The quantity of this oil collected little corres-

* La cosecha de la manteca.

ponds with the carnage made every year in the grotto by the Indians. It appears, that they do not get above 150 or 160 bottles* of very pure *manteca*; the rest, less transparent, is preserved in large earthen vessels. This branch of industry reminds us of the harvest of pigeons' oil †, of which some thousands of barrels were formerly collected in Carolina. At Caripe, the use of the oil of guacharoes is very ancient, and the missionaries have only regulated the method of extracting it. The members of an Indian family, which bears the name of Morocoymas, pretend, as descendants of the first colonists of the valley, to be the lawful proprietors of the cavern, and arrogate to themselves the monopoly of the fat; but, thanks to the monastic institutions, their rights at present are merely honorary. In conformity to the system of the missionaries, the Indians are obliged to furnish guacharo-oil for the church lamp: the rest, we were assured, is purchased of them. We shall not decide either on the legitimacy of the rights of the Morocoymas, or on the origin of the obligation imposed on the natives by the monks. It would seem natural, that the produce of the chace should belong to those who hunt: but in the forests of the New World, as in the centre of

* Sixty cubic inches each.

† This *pigeon oil* comes from the columba migratoria (Pennant's Arctic Zoology, T. 2, p. 13).

European cultivation, public might is modified according to the relations, which are established between the strong and the weak, the victors and the vanquished.

The race of the guacharoes would have been long ago extinct, had not several circumstances contributed to it's preservation. The natives, restrained by their superstitious ideas, have seldom the courage to penetrate far into the grotto. It appears also, that birds of the same species dwell in neighbouring caverns, which are too narrow to be accessible to man. Perhaps the great cavern is repeopled by colonies, that abandon the small grottoes; for the missionaries assured us, that hitherto no sensible diminution of the birds had been observed. Young guacharoes have been sent to the port of Cumana, and have lived there several days without taking any nourishment; the seeds offered to them not suiting their taste. When the crops and gizzards of the young birds are opened in the cavern, they are found to contain all sorts of hard and dry fruits, which furnish, under the singular name of guacharo seed, *semilla del guacharo,* a very celebrated remedy against intermittent fevers. The old birds carry these seeds to their young. They are carefully collected, and sent to the sick at Cariaco, and other places of the low regions, where fevers are prevalent.

We followed, as we continued our progress through the cavern, the banks of the small river, which issued from it, and is from twenty-eight to thirty feet wide. We walked on the banks, as far as the hills formed of calcareous incrustations permitted us. When the torrent winds among very high masses of stalactites, we were often obliged to descend into it's bed, which is only two feet in depth. We learnt, with surprise, that this subterraneous rivulet is the origin of the river Caripe, which, at a few leagues distance, after having joined the small river of Santa Maria, is navigable for canoes. It enters into the river Areo under the name of *Canno de Terezen.* We found on the banks of the subterraneous rivulet a great quantity of palm-tree wood, the remains of trunks, on which the Indians climb to reach the nests hanging to the roofs of the cavern. The rings, formed by the vestiges of the old footstalks of the leaves, furnish as it were the footsteps of a ladder perpendicularly placed.

The Grotto of Caripe preserves the same direction, the same breadth, and it's primitive height of sixty or seventy feet, to the distance of 472 metres, or 1458 feet, accurately measured. I have never seen a cavern, in either continent, of so uniform and regular a construction. We had great difficulty in persuading the Indians to pass beyond the outer part of the grotto, the

only part which they annually visit to collect the fat. The whole authority of *los padres* was necessary, to induce them to advance as far as the spot, where the soil rises abruptly at an inclination of sixty degrees, and where the torrent forms a small subterraneous cascade *. The natives connect mystic ideas with this cave, inhabited by nocturnal birds; they believe, that the souls of their ancestors sojourn in the deep recesses of the cavern. "Man," say they, "should avoid places which are enlightened neither by the Sun *(Zis)*, nor by the Moon *(Nuna)*." To go and join the guacharoes, is to rejoin their fathers, is to die. The magicians *(piaches)* and the poisoners *(imorons)* perform their nocturnal tricks at the entrance of the cavern, to conjure the chief of the evil spirits *(ivorokiamo)*. Thus in every climate the first fictions of nations resemble each other, those especially which relate to two principles governing the world, the abode of souls after death, the happiness of the virtuous, and the punishment of the guilty. The most different and most barbarous languages present a certain number of images, which are the same, because they have their source in the nature of our intellect and our sensations. Darkness is

* We find this phenomenon of a subterranean cascade, but on a much larger scale, in England at Yordas Cave, near Kingsdale, in Yorkshire.

every where connected with the idea of death. The Grotto of Caripe is the Tartarus of the Greeks; and the guacharoes, which hover over the rivulet, uttering plaintive cries, remind us of the Stygian birds.

At the point where the river forms the subterraneous cascade, a hill covered with vegetation, which is opposite the opening of the grotto, presents itself in a very picturesque manner. It appears at the extremity of a straight passage, 240 toises in length. The stalactites, which descend from the vault, and which resemble columns suspended in the air, display themselves on a back-ground of verdure. The opening of the cavern appeared singularly contracted, when we saw it about the middle of the day, illumined by the vivid light reflected at once from the sky, the plants, and the rocks. The distant light of day formed somewhat of magical contrast with the darkness, that surrounded us in those vast caverns. We discharged our pieces at a venture, wherever the cries of the nocturnal birds, and the flapping of their wings, led us to suspect, that a great number of nests were crowded together. After several fruitless attempts, Mr. Bonpland succeeded in killing a couple of guacharoes, which, dazzled by the light of the torches, seemed to pursue us. This circumstance afforded me the means of drawing this bird, which hitherto had

remained unknown to naturalists. We climbed, not without some difficulty, the small hill, whence the subterraneous rivulet descends. We saw, that the grotto was perceptibly contracted, retaining only forty feet in height; and that it continued stretching to the North-east, without deviating from it's primitive direction, which is parallel to that of the great valley of Caripe.

In this part of the cavern, the rivulet deposes a blackish mould, very like the matter, which in the grotto of Muggendorf, in Franconia, is called the *earth of sacrifice* *. We could not discover, whether this fine and spongy mould fall through the cracks, which communicate with the surface of the ground above; or be washed down by the rainwater, that penetrates into the cavern. It was a mixture of silex, alumin, and vegetable *detritus*. We walked in thick mud to a spot, where we beheld with astonishment the progress of subterraneous vegetation. The seeds, which the birds carry into the grotto to feed their young, spring up wherever they can fix in the mould, that covers the calcareous incrustations. Blanched stalks, with some half formed leaves, had risen to the height of two feet. It was impossible to ascertain the

* *Opfer-erde* of the cavern of *Hole Berg* (mountain pierced entirely through).

species of plants, the form, colour, and aspect of which had been changed by the absence of light. Those traces of organization amid darkness forcibly excited the curiosity of the natives, in general so stupid, and difficult to be moved. They examined them in that silent meditation inspired by a place they seemed to dread. It might be thought, that these subterraneous vegetables, pale and disfigured, appeared to them phantoms banished from the face of the Earth. To me the scene recalled one of the happiest periods of my early yonth, a long abode in the mines of Freiberg, where I made experiments on the effects of blanching *(étiolement)* *, which are very different, according as the air is pure, or overcharged with hydrogen or azot.

The missionaries, with all their authority, could not prevail on the Indians to penetrate farther into the cavern. As the vault grew lower, the cries of the guacharoes became more shrill. We were obliged to yield to the pusillanimity of our guides, and trace back our steps. The appearance of the cavern was indeed very uniform. We find, that a bishop of St. Thomas of Guiana had gone farther than ourselves. He had measured nearly 2500 feet † from the mouth to

* Humboldt, Aphorismi ex Physiologia chemica Plantarum (Flora Friberg. subterranea, p. 181.).

† 960 *varas*.

the spot where he stopped, though the cavern reached farther. The remembrance of this fact was preserved in the convent of Caripe, without the exact period being noted. The bishop had provided himself with great torches of white wax of Castille. We had torches composed only of the bark of trees, and native resin. The thick smoke which issued from these torches, in a narrow subterranean passage, hurts the eyes, and obstructs the respiration.

We followed the course of the torrent to go out of the cavern. Before our eyes were dazzled with the light of day, we saw, without the grotto, the water of the river sparkling amid the foliage of the trees that concealed it. It was like a picture placed in the distance, and to which the mouth of the cavern served as a frame. Having at length reached the entrance, and seated ourselves on the bank of the rivulet, we rested after our fatigues. We were glad to be beyond the hoarse cries of the birds, and to leave a place where darkness does not offer even the charm of silence and tranquillity. We could scarcely persuade ourselves, that the name of the Grotto of Caripe had hitherto remained unknown in Europe *. The guacharoes alone

* We have reason to be surprised, that Father Gili, author of the Saggio di Storia Americana (Tom. 4, p. 414), did not mention it, though he had in his possession a manuscrip composed in 1780 at the convent of Caripe. I gave the

would have been sufficient, to render it celebrated. These nocturnal birds have been no where yet discovered, except in the mountains of Caripe and Cumanacoa.

The missionaries had prepared a repast at the entry of the cavern. Leaves of bananas and vijao *, which have a silky lustre, served us as a table cloth, according to the custom of the country. Nothing was wanting to our enjoyment, not even remembrances, which are so rare in those countries, where generations disappear without leaving a trace of their existence. Our hosts took pleasure in reminding us, that the first monks, who came into those mountains to found the little village of Santa Maria †, had lived during a month in the cavern; and there, on a stone, by the light of torches, had celebrated the mysteries of religion. This solitary retreat served as a refuge

first information respecting the *Cueva del Guacharo* in 1800, in my letters to Messrs. Delambre and Delamétherie, published in the Journal de Physique. See also my Geog. des Plantes, p. 84.

* Heliconia bihai, Lin. The Creoles have changed the *b* of the Haytian word bihao into *v*, and the *h* into *j*, agreeably to the Castilian pronunciation.

† This village, situate to the South of the cavern, was formerly the chief place of the Chayma Missions. It is for this reason, that in the *Chorographia* of Father Caulin, p. 7 and 310, he mentions them as *Missiones de Santa Maria de los P. P. Capuchinos Aragoneses.*

to the missionaries against the persecutions of a warlike chief of the Tuacopans, encamped on the banks of the river Caripe.

Before we quit the subterraneous rivulet and the nocturnal birds, let us cast a last glance at the cavern of Guacharo, and the whole of the physical phenomena it presents. When we have followed the traveller step by step, in a long series of observations modified by the localities of a place, we love to stop, and raise our views to general considerations. Do the great cavities, which are exclusively called caverns, owe their origin to the same causes, as have produced the *lodes* of veins and of metalliferous strata, or the extraordinary phenomenon of the porosity of rocks? Do grottoes belong to every formation, or to that period only, when organized beings began to people the surface of the globe? These geological questions can be solved only so far as they have for their object the actual state of things, that is, of facts susceptible of being verified by observation.

Considering rocks according to the succession of eras, we find, that the primitive formations exhibit very few caverns. The great cavities, which are observed in the oldest granite; and which are called *fours* [ovens] in Switzerland, and in the South of France, when they are lined with rock crystals; arise most frequently from the union of several contemporaneous veins of

quartz *, of feldspar, or of fine-grained granite. The gneiss presents, though more seldom, the same phenomenon; and near Wunsiedel †, at the Fichtelgebirge, I had an opportunity of examining *crystal fours* of two or three feet diameter, in a part of the rock, which was now traversed by veins. We are ignorant of the extent of the cavities, which the subterraneous fires and volcanic agitations may have produced in the bowels of the earth in those primitive rocks, which, containing considerable quantities of hornblende, mica, garnets, magnetic ironstone, and red schorl (titanite), appear to be anterior to granite, and of which we find some fragments among the matters ejected by volcanoes. Those cavities can be considered only as partial and local phenomena; and their existence is scarcely any contradiction to the notions we have acquired, from the luminous experiments of Maskelyne and Cavendish, of the mean density of the Earth.

In the primitive mountains open to our researches, real grottoes, those which have some extent, belong only to calcareous formations, to

* *Gleichzeitige truemmer.* It is to these stone veins, that appear to be of the same epoch as the rock, that belong the veins of talc and asbestus in the serpentine, and those of quartz traversing the schistus (thonschiefer). *Jameson on contemporaneous Veins*, in the *Mem. of the Werner. Soc.*, *T.* 1, *p.* 4.

† In Franconia, South-east from Luchsburg.

the carbonats or sulphat of lime. The solubility of these substances appears to have favored the action of the subterraneous waters for ages. The primitive limestone presents spacious caverns, as well as transition limestone *, and that which is exclusively called secondary. If these caverns be less frequent in the first, it is because this stone forms in general only layers subordinate to the mica-slate †, and not a system of particular mountains, into which the waters may filter, and circulate to great distances. The erosions occasioned by this element depend not only on it's quantity, but also on the greater or less time it remains, the velocity it acquires by it's fall, and the degree of solubility of the rock. I have observed in general, that the waters act more easily on the carbonats and the sulphats of lime of secondary mountains, than on the transition limestones, which have a considerable mixture of silex and carbon. On examining the internal structure of the stalactites, which line the walls of ca-

* In the primitive limestone are found the Kuetzel-loch, near Kaufungen in Silesia, and probably several caverns in the islands of the Archipelago. In the transition limestone we remark the caverns of Elbingerode, of Rubeland, and of Scharzfeld, in the Hartz; those of the Salzflueh in the Grisons; and, according to Mr. Greenough, that of Torbay in Devonshire.

† Sometimes to gneiss, as at the Simplon, between Dovredo and Crevola.

verns, we find all the characters of a chemical precipitate. The carbonat of lime has not been held in suspension; it has been actually dissolved. I am aware, that, in the experiments of our laboratories, this substance appears soluble only in water strongly impregnated with carbonic acid: but the phenomena, which nature daily presents in caverns and springs, are sufficient proofs, that a small quantity of carbonic acid is sufficient, to give water, after long contact, the power of dissolving some portion of carbonat of lime.

As we approach those periods, in which organic life displays itself in a greater number of forms, the phenomenon of grottoes becomes more frequent. There exist several under the name of *baumen**, not in the ancient sandstone, to which the great coal formation belongs, but in the Alpine limestone, and in the Jura limestone, which is often only the superiour part of the Alpine formation. The Jura limestone so abounds with caverns † in both conti-

* In the dialect of the German Swiss, *Balmen*. The Baumen of the Sentis, of the Mole, and of the Beatenberg, on the borders of the lake of Thun, belong to the Alpine limestone.

† I shall mention only the grottoes of Boudry, Motiers-Travers, and Valorbe, in the Jura; the grotto of Balme near Geneva; the caverns between Muggendorf and Gailenruth in Franconia; Sowia Jama, Ogrodzimiec, and Wlodowice, in Poland.

nents, that several geologists of the school of Freiberg have given it the name of cavern limestone, *hœhlenkalkstein.* It is this rock which so often interrupts the course of rivers *, by ingulfing them into it's bosom. It is this also, which includes the famous *Cueva del Guacharo,* and the other grottoes of the valley of Caripe. The muriatiferous gypsum †, whether it be found in layers in the Jura or Alpine limestone, or whether it separate these two formations, or lie between the Alpine limestone, and argillaceous sandstone, presents also, on account of it's great solubility, enormous cavities, which sometimes communicate with each other at several leagues distance. When these subterraneous basins ‡ are filled with water, their proximity becomes dangerous to the miners, whose works they expose to unforeseen inundations. If the caverns, on the contrary, be dry, and very spacious, they are useful in freeing a mine from water. Distributed in stages, they may receive the waters into their upper part, and assist the efforts of industry by serving as subterraneous drains dug out by nature. After the limestone and gypseous formations,

* This geological phenomenon had very much attracted the notice of the ancients. Strabo, Geogr., lib. 6 (ed Oxon., 1807, T. 1, p. 397).

† Gypsum of Bottendorf, *schlottengyps.*

‡ Kalkschlotten, in Thuringia.

there would remain to examine, among the secondary rocks, a third formation, that of the argillaceous sandstone *, newer than the brine-spring formations: but this rock, composed of small grains of quartz cemented by clay, seldom contains caverns; and when it does, they are not extensive. Progressively narrowing toward their extremity †, their walls are covered with a brown ochre.

We have just seen, that the form of grottoes depends partly on the nature of the rocks in which they are found; but this form, modified by exterior agents, often varies also in the same formation. The configuration of caverns, like the outline of mountains, the sinuosity of vallies, and so many other phenomena, present at first sight only irregularity and confusion. The appearance of order is resumed, when we can extend onr observations over a vast space of ground, which has undergone violent, but periodical and uniform revolutions. From what I have seen in the mountains of Europe, and in the Cordilleras of America, caverns may be divided, according to their interior structure, into three classes. Some have the form of large clefts, or crevices, like veins not filled with ore;

* Sandstone of Weisenfels and of Nebra, oölite sandstone, *bunte sandstein*.

† Such are the Heuscheune in Silesia; the Diebskeller, and the Kuhstall, in Saxony.

such as the cavern of Rosenmuller, in Franconia, Elden-hole, in the peak of Derbyshire, and the *Sumideroes* of Chamacasapa* in Mexico. Other caverns are open to the light at both ends. These are rocks really pierced through; natural galleries, which traverse a solitary mountain. Such are the Hole-Berg of Muggendorf, and the famous cavern called *Dantoe* by the Ottomite Indians, and the *Bridge of the Mother of God*, by the Mexican Spaniards. It is difficult to decide respecting the origin of these channels, which sometimes serve as a bed for subterraneous rivers. Are these pierced rocks hollowed out by the impulse of a current? or should we rather admit, that one of the openings of the cavern is owing to a falling down of the earth subsequent to it's original formation, to a change in the external form of the mountain, for instance, to a new valley opened on it's flank? A third form of caverns, and the most common of the whole, exhibits a succession of cavities, placed nearly on the same level, in the same direction, and communicating with each other by passages of greater or less breadth.

To these differences of general form are added other circumstances not less remarkable. It often happens, that to grottoes of little space the openings are extremely wide; while we have to creep under very low vaults, in order to pe-

* Near Tasco, and Tehuilotepec.

netrate into the deepest and most spacious caverns. The passages, which unite partial grottoes, are generally horizontal. I have seen some, however, which resemble funnels or wells, and which may be attributed to the disengagement of some elastic fluid through a mass not yet hardened. When rivers issue from grottoes, they form only a single, horizontal, continued channel, the dilatations of which are almost imperceptible; such are the Cueva del Guacharo, which we have just described, and the cavern of St. Philip, near Tehuilotepec, in the western Cordilleras of Mexico. The sudden disappearance * of the river, which took it's rise from this last cavern, has caused the impoverishment of a district, the farmers and miners of which have equally need of water, to refresh the fields, and to move their hydraulic machines.

On considering this variety of structure exhibited by the grottoes in both hemispheres, we are compelled to refer their formation to causes totally different. When we speak of the origin of caverns, we must choose between two systems of natural philosophy, one of which attributes every thing to instantaneous and violent commotions; for instance, to the elastic force of vapours, and to the heavings occasioned by volcanoes; while the other has recourse to small

* In the night of the 16th of April, 1802.

powers, which produce their effect almost insensibly by progressive action. It would be in contradiction to the design of this work, which treats of the *laws of nature*, to discuss the *origin of things*, and abandon the small number of facts hitherto well observed, to wander amid vague conjectures. We will only recommend to those natural philosophers, who like to indulge in geological hypotheses, not to forget the horizontality, which is so often remarked in the bosom of gypseous and calcareous mountains to a vast extent, in the position of grottoes that communicate with each other by passages. This almost perfect horizontality, this gentle and uniform slope, appear to be the result of a long abode of the waters, which enlarge by erosion clefts already existing, and carry off the softer parts * so much the more easily, as clay or muriat of soda is found mixed with the gypsum and fetid limestone †. These effects are the same, whether the caverns form one long and continued range, or several of these ranges lying one over another, as happens almost exclusively in gypseous mountains.

* Saussure, Voyages, §. 465, Freiesleben, Kupferschiefer, T. ii, p. 172.

† *Stinkstein.* According to an hypothesis of Mr. Werner, the caverns in the ancient gypsum of Thuringia are owing to the abstraction of enormous masses of muriat of soda.

What in the shelly or Neptunean rocks is owing to the action of the waters, appears to be sometimes in the volcanic rocks the effect of gaseous emanations *, which act in the direction where they find the least resistance. When melted matter moves on a very gentle slope, the great axis of the cavity formed by the disengagement of elastic fluids is nearly horizontal, or parallel to the plane on which the movement of transition takes place. A similar disengagement of vapours, joined to the elastic force of the gasses, which penetrate strata softened and raised up, appears to give sometimes a great extent to the caverns, which are joined in the *trachytes* or trappean porphyries. These porphyritic caverns, in the cordilleras of Quito and Peru, bear the Indian name of *Machays*†. They are in general of little depth, lined with sulphur, and differ by the enormous size of their openings from those which the volcanic

* At Mount Vesuvius the Duke of Torre showed me, in 1805, in currents of recent lava, cavities extended in the direction of the current, six or seven feet long and three feet high. These little volcanic caverns were lined with iron-glance, which cannot be called *oligistc* iron, since Mr. Gay-Lussac's last experiments on the oxides of iron.

† Machay is a word of the Qquichua language, called commonly by the Spaniards *the Inca's language*. Thus *Callanca-machay* means "a cavern as large as a house," a cavern that serves a as *tambo*, or caravansary.

tufas * present in Italy, at Teneriffe, and in the Andes. Thus it is by connecting in the mind the primitive, secondary, and volcanic rocks, and making a distinction between the oxidated crust of the globe, and the interior nucleus, composed perhaps of metallic and inflammable substances, that we every where recognize the existence of grottoes. They act in the œconomy of nature as vast reservoirs of water and of elastic fluids.

The gypseous caverns glitter with the splendor of the chrystallized *selenite*. Vitreous chrystallized plates of brown and yellow display themselves in a striped ground composed of layers of alabaster and fetid lime-stone. The calcareous grottoes have a more uniform tint. They are more beautiful, and richer in stalactites, in proportion as they are narrower, and the circulation of air is less free. It is on account of it's being too spacious, and too accessible to air, that the cavern of Caripe is almost destitute of those incrustations, the imitative forms of which excite in other countries the curiosity of

* Sometimes fire acts like water in carrying off subtances: and thus the cavities may be caused by an igneous, though more frequently by an aqueous erosion or solution. Captain Flinders, whose melancholy and untimely end the friends of science deplore, attributes a cavern, near the plantation Menil in the Isle of France, to a mass of glance-iron melted and carried away by a volcanic eruption. Voyages to Terra Australis, vol. ii, p. 415.

the people. I also sought in vain for subterranean plants, those cryptogamous plants of the family of the *usneaceæ*, which we sometimes find fixed on the stalactites, as ivy on our walls, at the moment when we penetrate for the first time into a lateral grotto *.

The caverns in the mountains of gypsum often contain mephitic emanations and deleterious gasses †. It is not the sulphat of lime, that acts on the atmospheric air, but the clay slightly mixed with carbon, and the fetid limestone, which are so often mingled with the gypsum. We cannot yet decide, whether the swinestone act as a hydrosulphuret, or by means of a bituminous principle ‡. It's property of absorbing

* Thus the lichen tophicola was discovered when the fine cavern of Rosenmueller in Franconia was first opened. (Humb., *Ueber die Grubenwetter*, p. 39.) The cavity containing the lichen was closed on all sides by enormous masses of stalactites. This example is not favorable to the opinion of some natural philosophers, who think, that the subterranean plants, described by Scopoli, Hoffmann, and myself, are cryptogamiæ of our forests, accidentally conveyed into mines with the timber, employed in working them, and disfigured by the effects of blanching.

† Freiesleben, Vol. ii., p. 189.

‡ Ib. vol. ii, p. 16—22. The *stinkstein* is constantly of a blackish brown colour; it is only by decomposition that it becomes white, after having acted on the surrounding air. The stinkstein, which is of secondary formation, must not be confounded with a primitive granular limestone, very white, of the island of Thasos, which emits when scraped a smell

oxygen gas is known to all the miners of Thuringia. It is the same as the action of the carburetted clay of the gypseous grottoes, and of the great chambers *(sinkwerke)*, which are dug out in the mines of fossil salt worked by the introduction of fresh water. The caverns of the calcareous mountains are not exposed to those decompositions of the atmospheric air, unless they contain bones of quadrupeds, or that mould mixed with animal gluten and phosphat of lime, from which arise, as we above observed, inflammable and fetid gasses.

Notwithstanding all the inquiries we made among the inhabitants of Caripe, Cumanacoa, and Cariaco, we did not learn, that they had ever discovered in the cavern of Guacharo either the remains of carnivorous animals, or those breccia penetrated with bones of herbivorous animals, which are found in the caverns of Germany and Hungary, and in the clefts of the calcareous rocks of Gibraltar. The fossile bones of the megatherium, of elephants, and of mastodontes, which travellers have brought from South America, were all found in the light soil of the valleys, or elevated table-lands.

of sulphuretted hydrogen. This marble is larger grained than that of Carara (marmor lunense). It has been frequently employed by the Grecian sculptors, and I often picked up fragments of it at the Villa Adriani, near Rome.

Excepting the megalonyx *, a kind of sloth of the size of an ox, described by Mr. Jefferson, I know not a single instance of the skeleton of an animal buried in a cavern of the New World. The extreme scarcity of this geological phenomenon appears less surprising, if we recollect, that in France, England, and Italy, there are also a great number of grottoes, in which we have never met with any vestige of fossile bones †.

Although, in primitive nature, whatever relates to the ideas of extent and mass is of no great importance, I must nevertheless observe, that the cavern of Caripe is one of the most spacious, that is known in limestone formations. It is at least 900 metres or 2800 feet in length ‡. In general, on account of the different degrees of the solubility of the rocks, it is

* The megalonyx was found in the caverns of Green Briar, in Virginia, at 1500 leagues distance from the megatherium, which resembles it very much, and is as big as the rhinoceros. (Americ. Trans., No. 30, p. 246.)

† Cuvier, Recherches sur les Ossemens Fossiles, T. iv, Ours, p. 10.

‡ The famous Baumannshole in the Hartz, according to Messrs. Gilbert and Ilsen, is only 578 feet in length; the cavern of Scharzfeld 350; that of Gailenruth 304; that of Antiparos 300 (Freiesleben, T. ii, p. 165). But according to Saussure (Voyages, § 465), the Grotto of Balme is 1300 feet long.

not in calcareous mountains, but in gypseous formations, that we find the most extensive succession of grottoes. We know in Saxony some in gypsum, that are several leagues in length; for instance, that of Wimelbourg, which communicates with the cavern of Cresfeld.

The most curious observation, that grottoes present to the natural philosopher, is the exact determination of their temperatures. The cavern of Caripe, situate nearly in the latitude of 10° 10′, consequently in the centre of the torrid zone, is elevated 506 toises above the level of the water in the Gulf of Cariaco. We found in every part of it, in the month of September, the temperature of the interior air between 18·1° and 18·9° of the centesimal thermometer; the external atmosphere being at 16·2°. At the entrance of the cavern, the thermometer in the air was at 17·6°; but when immersed in the water of the little subterraneous river, it marked, even to the end of the cavern, 16·8°. These experiments are very interesting, if we reflect on the equilibrium of heat, which tends to establish itself between the waters, the air, and the earth. When I left Europe, natural philosophers still regretted, that they had not sufficient data on what is called, perhaps a little pompously, *the temperature of the interior of the globe;* and it

is but very recently, that pains had been taken with some success, to solve this grand problem of subterraneous meteorology. The stony strata, that form the crust of our planet, are alone accessible to our examination; and we now know, that the mean temperature of these strata varies not only with the latitudes and the heights, but that, according to the position of the several places, it performs also, in the space of a year, regular oscillations round the mean heat of the neighbouring atmosphere. We are already far from that period, when men were surprised to find, under other zones, the heat of grottoes and wells differing from that, which is observed in the caves of the observatory at Paris. The same instrument, which in those caves marks 12°, rises in the subterraneous caverns of the island of Madeira, near Funchal *, to 16·2°; in Joseph's Well, at Cairo †, to 21·2°; in the grottoes of the Island

* At Funchal (lat. 32° 37′) the mean temperature of the air is 20·4°. This is so much the more probable, as Mr. Escolar finds at Santa Cruz, in Teneriffe, 21·8° (Cavendish, in the Philosoph. Trans. for 1778, p. 392). We shall hereafter recur again to this remarkable difference between the caves in the island of Madeira and the surrounding atmosphere.

† At Cairo (lat. 30° 2′) the mean temperature of the air is 22·4°, according to Nouet.

of Cuba * to 22° or 23°. This increase is nearly in proportion to that of the mean temperature of the atmosphere, from the latitude of 48° to the tropics.

We have just seen, that in the Cueva del Guacharo, the water of the river is nearly 2° colder than the ambient air of the cavern. The water, whether in filtering through the rocks, or in running on stony beds, assumes without doubt the temperature of these beds. The air contained in the grotto, on the contrary, is not in repose; it communicates with the atmosphere without. Though under the torrid zone, the changes of the exterior temperature are exceedingly small: currents are formed, which modify periodically the internal air. It is consequently the temperature of the waters, that of 16·8°, which we might look upon as the temperature of the earth in those mountains, if we were sure, that these waters do not descend with rapidity from more elevated neighbouring mountains.

It follows from these observations, that, when we cannot obtain results perfectly exact, we find at least under each zone certain numbers, which indicate the *maximum* and *minimum*. At Caripe, in the equinoxial zone, at 500 toises of

* Obs. Astr. Tom. i, p. 134. The mean temperature of the air at the Havannah, according to Mr. Ferrer, is 25·6°.

height, the mean temperature of the globe is not below 16·8°, which was what the water of the subterranean river indicated. We can even prove, that this temperature of the globe is not above 19°; since the air of the cavern, in the month of September, was found at 18·7°. As the mean temperature of the atmosphere, in the hottest month, does not exceed 19·5° *, it is probable, that a thermometer, placed in the open air in the grotto, would not rise higher than 19° in any season of the year. These results, as well as many others, which we have recorded in this journey, seem of little importance, on viewing them singly; but, if we compare them with the observations recently made by Messrs. von Buch and Wahlenberg, under the polar circle, they throw light on the economy of nature in general, and the equilibrium of temperature, toward which the air and earth are continually tending. It is no longer doubtful, that in Lapland the stony crust of the globe is three or four degrees above the mean temperature of the atmosphere. Does the cold, which perpetually reigns in the abysses of the Equinoc-

* The mean temperature of the month of September at Caripe is 18·5°; and on the coast of Cumana, where we had opportunities of collecting a great number of observations, the mean heat of the warmest months differs only 1·8° from that of the coldest.

tial Ocean, and which is the effect of the polar currents, produce, under the tropics, a sensible diminution of the temperature of the earth? Is this temperature below that of the atmosphere? This we mean to examine hereafter, when we have collected more facts in the high regions of the Cordillera of the Andes.

CHAPTER VIII.

Departure from Caripe.—Mountain and Forest of Santa Maria.—Mission of Catuaro.—Port of Cariaco.

THE days we passed at the convent of the Capuchins, in the mountains of Caripe, glided hastily away, though our manner of living was simple and uniform. From sunrise to nightfall we traversed the forests and neighbouring mountains, to collect plants, of which we had never made a more considerable harvest. When the winter rains prevented us from undertaking distant excursions, we visited the huts of the Indians, the *conuco* of the community, or those assemblies, in which the alcaides settle every evening the labours of the succeeding day. We returned to the monastery, only when the sound of the bell called us to partake in the refectory the repast of the missionaries. Sometimes, very early in the morning we followed them to the church, to attend the *doctrina,* that is to say, the religious instruction of the Indians. It is an undertaking at least very difficult, to speak

of dogmas to neophytes, especially when they have but a very imperfect knowledge of the Spanish language. On the other hand, the monks are at present almost totally ignorant of the idiom of the Chaymas; and the resemblance of sounds confuses the minds of these poor Indians so much, that it awakens in them the most whimsical ideas. I shall cite only one example. I beheld a missionary violently agitated in proving, that *Infierno*, Hell, and *invierno*, winter, were not the same thing; but that they were as different as heat and cold. The Chaymas are acquainted with no other winter, than the season of rains; and the *Hell of the whites* appeared to them a place, where the wicked are exposed to frequent showers. The missionary harangued to no purpose: it was impossible to efface the first impressions, produced by the analogy between the two consonants; and he could not separate in the minds of the neophytes the ideas of *rain* and *Hell*, *invierno*, and *Infierno*.

After having passed almost the whole of the day in the open air, we employed our evenings, when returned to the convent, in making notes, drying our plants, and sketching those that appeared to form new genera. The monks left us to enjoy our full liberty, and we recollect with much satisfaction an abode at once agreeable and advantageous to our researches. Unfortu-

nately, the foggy atmosphere of a valley, where the forests yield to the air an enormous quantity of water, was unfavourable to astronomical observations. I spent a part of the nights waiting to seize the moment when some star was visible between the clouds, near it's passage over the meridian. I often shivered with cold, though the thermometer only sunk to 16°, which is the temperature of the day in our climates towards the end of September. The instruments remained set up in the court of the Convent for several hours, yet I was almost always disappointed in my expectations. Some good observations of Fomalhaut and of Deneb in the Swan gave 10° 10′ 14″ for the latitude of Caripe; which proves, that the position indicated in the maps of Caulin is 18′ wrong, and in that of Arrowsmith 14′.

Observations of corresponding altitudes of the Sun* having given me the true time to about 2″, I was enabled to determine with precision, at noon, the magnetic variation. It was, on the 20th of September, 1799, 3° 15′ 30″ north-east; consequently 0° 58′ 15″ less than at Cumana. If we attend to the influence of the horary variations, which in these countries do not exceed in general 8′, we shall find, that at considerable distances the variation changes

* See Obs. Ast., vol. i, p. 100—106.

less rapidly than is commonly thought. The dip of the needle was 42·75°, cent. div.; and the number of oscillations, expressing the intensity of the magnetic forces, rose to 229 in 10′.

The vexation of seeing the stars disappear in a foggy sky was the only one we felt in the valley of Caripe. The aspect of this spot has something in it at once wild and tranquil, gloomy and attractive. Amidst a nature so overwhelming, we experienced only feelings of peace and repose. I might even add, that we are less struck in the solitude of these mountains with the new impressions we receive at every step, than with the marks of resemblance which we trace in climates the most distant from each other. The hills, by which the convent is backed, are crowned with palm-trees and arborescent ferns. In the evenings, when the sky denotes rain, the air resounds with the uniform howlings of the alouate apes, which resemble the distant sound of wind, when it shakes the forest. Yet amid these unknown sounds, these strange forms of plants, and these prodigies of a new world, nature every where speaks to man in a voice, the accents of which are familiar to his soul. The turf, that is spread over the soil; the old moss and the fern, that cover the roots of the trees; the torrents, that gush over the sloping banks of the calcareous rocks; in fine, the harmonious agreement of colours reflected

by the waters, the verdure, and the sky; every thing recalls to the traveller sensations, which he has already felt.

The natural beauties of the mountains so much engaged us, that we perceived very tardily the embarrassment felt by the kind monks, by whom we were entertained. They had but a slender provision of wine and bread; and although in those high regions both are regarded as belonging to the luxuries of the table, we saw with regret, that our hosts went without them on our account. Our portion of bread had already been diminished three fourths, yet the most violent showers still obliged us to delay our departure for two days. How long did this delay appear! How we dreaded the sound of the bell, that summoned us to the refectory! The delicate conduct of the missionaries made us feel sensibly the contrast between our own situation and that of the travellers, who complain of having been robbed of their provision in the convents of the Copts in Upper Egypt.

We departed at length on the 22d of September, followed by four mules, loaded with instruments and plants. We had to descend the north-east slope of the calcareous Alps of New Andalusia, which we have called the great chain of the Brigantine and Cocollar. The mean height of this chain scarcely exceeds six

or seven hundred toises; and in this respect, and that of it's geological constitution, we may compare it to the chain of the Jura. Notwithstanding the inconsiderable elevation of the mountains of Cumana, the descent is one of the most difficult, we might say the most dangerous, on the side of Cariaco. The Cerro of Santa Maria, which the missionaries climb in their journey from Cumana to their convent at Caripe, is particularly famous for the difficulties it presents to travellers. On comparing these mountains, the Andes of Peru, the Pyrennees, and the Alps, which we have successively visited, it has more than once occurred to us, that the less lofty summits are sometimes the most inaccessible.

On leaving the valley of Caripe, we first crossed a ridge of hills situate to the north-east of the convent. The road led us on a continual ascent through a vast savannah, as far as the table-land of *Guardia de San Augustin*. We there halted to wait for the Indian, who carried the barometer; and found ourselves at 533 toises of absolute elevation, or a little higher than the bottom of the cavern of Guacharo. The savannahs or natural meadows, which yield excellent pastures for the cows of the convent, are altogether without trees or shrubs. It is the domain of the monocotyledonous plants; for amidst the gramina only a few plants of ma-

guey * rise here and there, the flowery stalks of which are more than 26 feet high. Having reached the table-land of Guardia, we appeared to be transplanted to the bottom of an old lake, levelled by the long-continued abode of the waters. We seemed to trace the sinuosities of the ancient shore, tongues of land that advance themselves, and craggy rocks that rise in the form of islands. This ancient state of things seems indicated even by the distribution of vegetation. The bottom of the basin is a savannah, while it's banks are covered with tress of full growth. This is probably the most elevated valley in the provinces of Venezuela and Cumana. It is to be regretted, that a spot where so temperate a climate is enjoyed, and which without doubt would be fit for the culture of corn, is totally uninhabited. From the table-land of Guardia we did nothing but descend, till we reached the Indian village of Santa Cruz. We passed at first by a slope extremely slippery and steep, to which the missionaries had given the singular name of Purgatory †. It is a rock of schistose sandstone, decomposed, covered with clay, and the talus of which appears of a frightful steepness; as from the effect of an optical illusion, which is very common, when we look from the

* Agave Americana.

† Baxada del Purgatorio.

top to the bottom the road seems inclined more than 60°. The mules in going down draw their hind legs near their fore legs, and, lowering their crupper, let themselves slide at a venture. The rider runs no risk, provided he loosens the bridle, and leaves the animal quite free in his movements. From this point we perceived toward the left the great pyramid of Guacharo. The appearance of this calcareous peak is very picturesque, but we soon lost sight of it, by entering into the thick forest, which is known by the name of the *Montana de Santa Maria*. We descended without interruption for seven hours, and it is difficult to form an idea of a more tremendous descent; it is a real *chemin des échelles* [road of steps], a kind of ravine, in which during the rainy season impetuous torrents tumble from rock to rock. The steps are from two to three feet high, and the unfortunate beasts of burden, after having measured with their eye the space necessary to let their load pass between the trunks of the trees, leap from one rock to another. Afraid of missing their leap, we saw them stop a few minutes to examine the ground, and bring together their four feet like wild goats. If the animal do not reach the nearest block of stone, he sinks half his depth into the soft ochrey clay, that fills up the interstices of the rock. When the blocks are wanting, enormous roots serve as supports to the feet of men and beasts. These

are some of them twenty inches thick, and often issue from the trunks of the trees much above the level of the soil. The Creoles have sufficient confidence in the address and happy instinct of the mules, to remain on their saddles during this long and dangerous descent. Fearing fatigue less than they did, and accustomed to travel slowly, in order to gather plants, and examine the nature of the rocks, we preferred going down on foot; and indeed the care, which our timekeepers demanded, left us no liberty of choice.

The forest, that covers the steep flank of the mountain of Santa Maria, is one of the thickest I ever saw. The trees are of a stupendous height and size. Under their bushy, deep green foliage, there reigns constantly a kind of half daylight, a sort of obscurity, of which our forests of pines, oaks, and beach-trees, afford no example. It might be said, that, notwithstanding it's elevated temperature, the air cannot dissolve the quantity of water exhaled from the surface of the soil, the foliage of the trees, and their trunks covered with an old drapery of orchideæ, peperomia, and other succulent plants. With the aromatic odour yielded by the flowers, the fruit, and even by the wood, is mingled that which we perceive in autumn in foggy seasons. Here, as in the forests of the Oronoko, fixing our eyes on the top of the

trees, we now discerned streams of vapour, whenever a solar ray penetrated, and traversed the dense atmosphere. Our guides pointed out to us among those majestic trees, the height of which exceeded 120 or 130 feet, the *curucay* of Terecen *, which yields a whitish, liquid, and very odoriferous resin, that was employed by the Cumanagoto and Tagiri Indians, to perfume their idols. The young branches have an agreeable taste, though somewhat astringent. After the curucay and enormous trunks of hymenæa, the diameter of which was more than nine or ten feet, the trees which most excited our attention were the dragon's blood (croton sanguifluum), the purple brown juice of which flows down a whitish bark; the calahuala fern, different from that of Peru, but almost equally medicinal †; and the palm-trees irasse, macanilla, corozo, and praga‡. The last yields a very savoury palm-cabbage, which we had sometimes eaten at the Convent

* See page 103 of this volume.

† The calahuala of Caripe is the polypodium crassifolium; that of Peru, the use of which has been so much extended by Messrs. Ruiz and Pavon, comes from the aspidium coriaceum, Wild. (tectaria calahuala, Cav.). They mix in commerce the diaphoretic roots of the polyp. crassifolium, and of the acrostichum huascaro, with those of the calahualo, or aspidium coriaceum.

‡ Aiphanes praga.

of Caripe. These palms with pinnated and thorny leaves formed a pleasing contrast with the fern trees. One of the latter, the cyathea speciosa *, rises to the height of more than thirty five feet, which is prodigious for plants of this family. We discovered here, and in the valley of Caripe, five new kinds of arborescent ferns †: in the time of Linnæus, botanists knew no more than four on both continents.

We observed, that the fern-trees are in general much more rare than the palm-trees. Nature has confined them to temperate, moist, and shady places. They shun the direct rays of the sun, and while the pumos, the corypha of the *steppes*, and other palms of America, flourish in the naked and burning plains, these ferns with arborescent trunks, which at a distance look like palm-trees, preserve the character and habits of the cryptogamous plants. They love solitary places, little light, a moist,

* Perhaps a hemitelia of Robert Brown. The trunk alone is from 22 to 24 feet long. This and the cyathea excelsa of the Isle of Bourbon are the most majestic of all the fern-trees described by botanists. The total number of these gigantic cryptogamous plants amounts at present to 25 species, that of the palm-trees to 80. With the cyathea grow on the Mountain of Santa Maria rhexia juniperina, chiococca racemossa, and commelina spicata.

† Meniscium arborescens, aspidium caducum, a. rostratum, cyathea villosa, and c. speciosa.

temperate, and stagnant air. If they sometimes descend toward the coast, it is only under cover of a thick shade. The old trunks of the cyathea, and the meniscium, are covered with a carbonaceous powder, which, probably deprived of hydrogen, has a metallic lustre like the graphite. No other plant presents us with this phenomenon; for the trunks of the dicotyledons, in spite of the heat of the climate, and the intensity of the light, are less burnt under the tropics than in the temperate zone. It may be said, that the trunks of the ferns, which, like the monocotyledons, are enlarged by the remains of the petiolæ, decay from the circumference toward the centre, and that, deprived of the cortical organs, through which the elaborated juices descend toward the roots, they are burnt more easily by the action of the oxygen of the atmosphere. I brought to Europe some of those powders of metallic lustre, taken from very old trunks of meniscium and aspidium.

As we descended the mountain of Santa Maria, we perceived the arborescent ferns diminish, and the number of palm trees increase. The beautiful butterflies with large wings, the nymphales, which fly at a prodigious height, became more common. Every thing announced that we drew near the coast, and approached a zone, the mean temperature of which was from 28 to 30 cent. degrees.

The weather was cloudy, and led us to fear one of those showers, during which from 1 to 1·3 inch of water sometimes falls in a day. The sun at times illuminated the tops of the trees; and, though sheltered from it's rays, we felt an oppressive heat. The thunder already rumbled at a distance; the clouds seemed suspended on the top of the lofty mountains of Guacharo; and the plaintive howling of the araguatoes, which we had so often heard at Caripe, denoted the proximity of the storm. We saw near us for the first time these howling apes. They are of the family of the alouates*, the different species of which authors have long confounded. While the small sapajous of America, which imitate in whistling the voice of the passeres, have the bone of the tongue thin and simple, the apes of large size, as the alouates and marimondes†, have the tongue placed on a large boney drum. Their superior larynx has six pouches, in which the voice loses itself; and two of which, shaped like pigeons' nests, resemble the inferior larynx of birds. The air driven with force into the boney drum produces that mournful sound, which characterises the araguatoes. I sketched on the spot these organs, imperfectly known to anatomists, and published the description of them on my return to

* Stentor, Geoffroy.

† Ateles, G.

Europe*. When we consider the dimensions of the boney cavity of the alouates, and the great number of howling monkeys that seat themselves on a single tree in the forests of Guiana and Cumana, we are less astonished at the force and volume of their blended voices.

The araguato, which the Tamanac Indians call aravata†, and the Maypures, marave, resembles a young bear. It is three feet long, reckoning from the top of the head, which is small and very pyramidal, to the beginning of the prehensile tail; it's fur is bushy, and of a reddish brown; the breast and belly are both covered with a fine hair, and not naked as in the *mono colorado*, or *alouate roux* of Buffon, which we carefully examined, in going from

* Zoolog. Obs., V. i, p. 8, pl. 4, No. 9.

† Gomara (*Hist. general de los Ind.*, cap. 80, p. 104). Fray Pedro Simon (*Noticias de la Conquista de Tierra Firme*, 1626; *not.* 4, *c.* 25, *p.* 317), and Father Caulin (*Hist. Cor.*, *p.* 33), describe this monkey by the names of *aranata*, and *araguato*. In both names we easily discover the same root. The *v* has been transformed into *g* and *n*. The name of *arabata*, which Gumilla gives to the howling apes of the Lower Oronoko, and which Mr. Geoffroy thinks belongs to the s. straminea of Great Para, is still the same Tamanac word *aravata*. This identity of names ought not to surprise us. We shall soon see, that the language of the Chayma Indians of Cumana is one of the numerous branches of the Tamanac language, and that the latter is connected with the Caribbee language of the Lower Oronoko.

Carthagena to Santa Fe de Bogota. The face of the araguato is of a blackish blue, and covered with a fine and wrinkled skin; it's beard is pretty long; and, notwithstanding the direction of the facial line, the angle of which is only of thirty degrees, the araguato has in the look, and in the expression of the countenance, as much resemblance to man, as the marimonde (s. belzebuth, Brèsson) and the capuchin of the Oronoko (s. chiropotes). Among thousands of araguatoes, which we observed in the provinces of Cumana, Caraccas, and Guiana, we never saw any change in the reddish brown fur of the back and shoulders, whether we examined individuals, or whole troops. It appeared to me in general, that variety of colours is less frequent among monkeys than naturalists think *. They are in particular very rare among those species, that live in society.

The araguato of Caripe is a new species of the genus stentor, that I have described under the name of *alouate ourse, simia ursina.* I preferred this name to those I might have derived from the colour of it's fur; and I was so much the more inclined to this, as a passage of Photius shows, that the Greeks were already acquainted with a hairy monkey under the name of *arctopithecos.* Our araguato differs equally

* Spix, in the Mem. of the Acad. of Munich, 1815, p. 340.

from the *ouarine* (s. guariba) and the *alouate roux* (s. seniculus, old man of the woods). It's eye, voice, and gait, denote melancholy. I have seen young araguatoes brought up in Indian huts. They never play like the little sagoins, and their gravity was described with much simplicity by Lopez de Gomara, in the beginning of the sixteenth century. "The *Aranata de los Cumaneses*," says this author, "has the face of a man, the beard of a goat, and a grave behaviour, *honrado gesto*." I have already observed, in another part of this work, that monkeys are more melancholy in proportion as they have more resemblance to man. Their petulant gaiety diminishes, as their intellectual faculties appear to increase*.

We stopped to observe the howling monkeys, which, to the number of thirty or forty, crossed the road, by passing in a long file from one tree to another upon the horizontal and intersecting branches. While this new sight fixed our attention, we met a troop of Indians going toward the mountains of Caripe. They were quite naked, as are generally the natives of this country. The women, laden with pretty heavy burdens, closed the march; the men were all armed, even the youngest children, with bows and arrows. They marched in silence, their

* Obs. Zoolog., vol. i, p. 329 and 355, pl. 30.

eyes fixed on the ground. We endeavoured to learn from them whether we were yet far from the Mission of Santa Cruz, where we intended passing the night. We were overcome with fatigue, and tormented with thirst. The heat increased as the storm drew near, and we had not met with a single spring on the way. The words *si Patre, no Patre,* which the Indians continually repeated, made us think they understood a little Spanish. In the eyes of a native every white man is a monk, a *Padre* *; for in the Missions the colour of the skin characterises the monk, more than the colour of the garment. We in vain pestered them with our questions on the length of the way: they answered, as if by chance, *si* and *no,* without our being able to attach any precise sense to their replies. This made us the more impatient, as their smiles and gestures discovered their intention of satisfying us; and the forest seemed at every step to become thicker. We separated at last; the Indian guides, who understood the Chayma tongue, being able to follow us only at a distance, because the beasts of burden fell at every step in the ravines.

After several hours march, continually descending on blocks of scattered rock, we found

* In Modern Greece, the monks are commonly called good old men, *kalogheroi.*

ourselves unexpectedly at the end of the forest of Santa Maria. A savannah*, the verdure of of which had been renewed by the winter rains, stretched before us farther than the eye could reach. On the left, we discovered a narrow valley, which ended at the mountains of Guacharo. The bottom of this valley is covered with a thick forest. The eye looked down on the tops of the trees, which, at eight hundred feet below the road, formed a carpet of verdure of a dark and uniform tint. The openings in the forest appeared like vast funnels, in which we distinguished by their elegant forms and pinnated leaves the palms praga and irasse. But what renders this spot eminently picturesque is the aspect of the *Sierra del Guacharo.* It's northern slope, which looks toward the Gulf of Cariaco, is abrupt; it displays a wall of rocks, an almost vertical profile, the height of which exceeds 3000 feet. The vegetation that covers this wall is so scanty, that the eye can follow the lines of the calcareous strata. The summit of the Sierra is flattened, and it is only at it's eastern extremity, that the majestic peak of the Guacharo rises like an inclined pyramid. It's form reminds us of the *needles* and *horns* * of the Alps. As most mountains

* We found in it the paspalum conjugatum, p. scoparium, isolepis junciformis, &c.

† Schreckhœrner, Finsteraarhorn.

with abrupt slopes appear more lofty than they really are, we need not be surprised, that the Guacharo is supposed in the Missions to be a height overlooking the Turimiquiri and Brigantine.

The savannah we crossed to the Indian village of Santa Cruz is composed of several smooth flats, lying above each other in steps. This geological phenomenon, which is repeated under every climate, seems to indicate a long abode of the waters in basins, that have poured them from one to the other. The calcareous rock no longer appears, but is covered with a thick layer of mould. The last time we saw it in the forest of Santa Maria, it was slightly porous, and looked more like the limestone of Cumanacoa than that of Caripe. We there found brown iron ore disseminated in patches, and, if we were not deceived in our observation, a cornu ammonis, which we could not succeed in our attempt to get out. It was seven inches diameter. This fact is so much the more important, as in this part of America we have never seen ammonitæ. The Mission of Santa Cruz is situate in the midst of the plain. We reached it toward the evening, suffering much with thirst, having travelled nearly eight hours without finding water. The thermometer kept at 26°; accordingly we were

not more than 190 toises above the level of the sea.

We passed the night under one of those ajúpas, which are called King's houses, and which, as I have already said, serve as *tamboes* or caravanserays to travellers. The rains prevented any observations of the stars; and the next day, the 23rd of September, we continued our descent toward the Gulf of Cariaco. Beyond Santa Cruz a thick forest begins anew; and in it we found, under tufts of melastomas, a beautiful fern, with osmundia leaves, which forms a new genus of the order of the polypodiaceous plants *.

Having reached the mission of Catuaro, we were desirous of continuing our journey toward the east by Santa Rosalia, Casanay, San Josef, Carupano, Rio Carives, and the mountain of Paria; but we learnt with great regret, that the torrents of rain had already rendered the roads impassable, and that we should run the risk of losing the plants we had already gathered. A rich planter of cacao-trees was to accompany us from Santa Rosalia to the port of Carupano; but we were informed in time, that his affairs had called him to Cumana, and we resolved in consequence to embark at Cariaco, and return directly by the Gulf, instead of passing between

* Polybotria.

the Island of Margaretta and the isthmus of Araya. The Mission of Catuaro is situate on a very wild spot. Trees of full growth still surround the church, and the tigers come by night to devour the fowls and hogs belonging to the Indians. We lodged at the dwelling of the priest, a monk of the congregation of the Observance, to whom the Capuchins had confided the Mission, because priests of their own community were wanting. He was a doctor of divinity, a little meagre man, and of petulant vivacity. He talked to us continually of the law-suit in which he was engaged with the superior of his convent, of the hatred of his brethren, and the injustice of the alcaides, who, without any respect for the privileges of his rank, had thrown him into a dungeon. Notwithstanding these misadventures, he retained an unfortunate predilection for what he called metaphysical questions. He wished to know what I thought of free-will, of the means of disengaging spirits from their corporeal prison, and, above all, my opinion on the souls of animals, of which he had formed the most singular ideas. After having just traversed forests in the rainy season, a man feels little taste for these kinds of speculations. Every thing, however, was extraordinary in this Mission of Catuaro, even the house of the vicar. It had two stories, and, on this account, had been the subject

of violent disputes between the ecclesiastic and secular authorities. The prefect of the Capuchins, thinking it too sumptuous for a missionary, endeavoured to force the Indians to demolish it. The governor had strenuously withstood this demolition; and his counsel prevailed against the monks. I mention these facts, though of little inportance in themselves, because they make us acquainted with the interior spirit of the Missions; which is not always so peaceable, as is supposed in Europe.

At the Mission of Catuaro we met the Corregidor * of the district, an amiable man, and of a cultivated mind. He gave us three Indians, who, armed with their *machetes*, were to precede us, and cut a way through the forest. In this country so little frequented, the power of vegetation is such at the period of the great rains, that a man on horseback passes with difficulty through narrow paths, covered with lianas, and intertwining branches. To our great regret, the missionary of Catuaro would absolutely conduct us to Cariaco. We could not refuse; he tormented us no longer with his reveries on the souls of animals, and the freewill of man; he had now to entertain us on a subject far more perplexing. The movement toward independence, which had nearly broken

* Don Alexandro Mexia.

out at Caraccas in 1798, had been preceded and followed by great agitation among the slaves at Coro, Maracaybo, and Cariaco. At the last of these places an unfortunate negro had been condemned to die, and our host, the vicar of Catuaro, went thither to offer him the assistance of his ministry. How long did this road appear to us, during which we could not escape conversations on "the necessity of the slave trade, on the innate wickedness of the blacks, and the benefit they derived from their state of slavery among the christians!"

The mildness of the Spanish legislation compared with the Black Code of the greater part of other nations that have possessions in either India, cannot be denied. But such is the state of the negroes, dispersed in places scarcely begun to be cultivated, that justice, far from efficaciously protecting them during their lives, cannot even punish acts of barbarity, that have caused their death. If an inquiry be attempted, the death of the slave is attributed to the bad state of his health, to the influence of a warm and humid climate, to the wounds which he has received, but which, it is asserted, were neither deep nor dangerous. The civil authority is powerless with respect to whatever constitutes domestic slavery; and nothing is more illusory than the effect so much vaunted of those laws, which prescribe the form of the whip, and the

number of lashes which it is permitted to give *at a time.* Persons who have not lived in the colonies, or have inhabited only the West India islands, believe in general, that the interest of the master in the preservation of his slaves must render their condition so much the milder as their number is less considerable. Nevertheless, even at Cariaco, a few weeks before my arrival in the province, a planter, who had only eight negroes, killed six by beating them in the most barbarous manner. He thus voluntarily destroyed the greater part of his fortune. Two of his slaves expired on the spot. He embarked with four, who seemed more robust, for the Port of Cumana, but they died on the passage. This act of cruelty had been preceded in the same year by another, the circumstances of which are equally horrible. Such great crimes remain almost always unpunished; the spirit, that dictated the laws, is not that which presides over their execution. The governor of Cumana was a just and humane man; but the judiciary forms are prescribed, and the power of the governor does not extend to a reform of abuses, which are almost inherent in every system of European colonization.

The road we followed across the forest of Catuaro resembles the descent of the mountain Santa Maria; and the most difficult passages are called here also by names equally whimsi-

cal. We walked as in a narrow furrow, scooped out by torrents, and filled with fine and tenacious clay. The mules lowered their crupper, and slid down the steepest slopes. This descent is called *Saca Manteca*, on account of the consistence of the mud, which is like butter. The danger of the descent is nothing, owing to the great address of the mules of this country. The clay, which renders the soil so slippery, is produced by the frequent layers of sandstone and schistose clay crossing the bluish-gray alpine limestone. This last disappears as we draw nearer to Cariaco. When we reached the mountain of Meapira, we found it formed in great part of a white limestone, filled with pelagic petrifactions, and appearing to belong, as is proved by the grains of quartz agglutinated in the mass, to the great formation of the seacoast breccia*. We descend this mountain on the strata of the rock, the section of which forms steps of unequal height. It is a real *chemin des échelles*. Farther on, going out of the forest, we reach the hill of *Buenavista*†. This hill is worthy of the name it bears; since from it may be seen the town of Cariaco, in the midst of a vast plain filled with plantations, huts, and scattered groups of cocoa palms. To

* See p. 10, of this volume, for an account of this sandstone or calcareous puddingstone formation.

† Mountain of the Fine Prospect.

the west of Cariaco extends the wide gulf, which a wall of rock separates from the ocean: and toward the east are seen like bluish clouds the high mountains of Paria and Areo*. This is one of the most extensive and magnificent prospects, that can be enjoyed on the coast of New Andalusia.

In the town of Cariaco we found a great part of the inhabitants confined to their hammocks, and sick of intermittent fevers. These fevers assume in autumn a formidable character, and run into pernicious dysenteries. When we consider the extreme fertility of the surrounding plains, their moisture, and the mass of vegetables that cover them, we may easily conceive, why, amid so many decompositions of organic matter, the inhabitants do not enjoy that salubrity of air, which characterises the dry country of Cumana. It is difficult to find under the torrid zone a great fecundity of soil, frequent and long continued rains, and an extraordinary luxury of vegetation, without these advantages being counterbalanced by a climate more or less fatal to the health of white men. The same causes, which preserve the fertility of the earth, and accelerate the growth of plants, produce gazeous emanations, that mingle with the atmosphere, and impart to it noxi-

‡ *Sierra de Areo*, and *Montana de Paria*.

ous properties. We shall often have occasion to remark the coincidence of these phenomena, when we come to describe the culture of the chocolate tree *, and the banks of the Oronoko where in some parts the natives themselves are seasoned to the climate with difficulty. In the valley of Cariaco, the insalubrity of the air does not depend solely on the general causes we have just pointed out: the peculiar influence of local circumstances is also felt. It will not be uninteresting to examine the nature of this ground, which separates the Gulf of Cariaco from that of Paria.

The chain of calcareous mountains of the Brigantine and the Cocollar † sends off a considerable branch to the north, which joins the primitive mountains of the coast. This branch bears the name of *Sierra de Meapira*; but toward the town of Cariaco it is called *Cerro grande de Cariaco*. It's mean height did not appear to me more than 150 or 200 toises. It was composed, where I could examine it, of the calcareous breccia of the seacoast. Marly and calcareous beds alternate with other beds containing grains of quartz. It is a very striking phenomenon for those who study the *relievo* of a country, to see a transverse ridge connect at

* Theobroma cacao.

† Nearly 0° 42′ east from the meridian of Cumana.

right angles two parallel ridges, of which one, the more southern, is composed of secondary rocks, and the other, the more northern, of primitive rocks. The latter, which we have already described in our excursion to the peninsula of Araya*, presents, nearly as far as the meridian of Carupano, only mica-slate; but to the east of this point, where it communicates by a transverse ridge (the Sierra de Meapira) with the limestone range, it contains lamellar gypsum †, compact limestone, and other rocks of secondary formation. It might be supposed, that it is the southern ridge that has given these rocks to the northern.

When standing on the summit of the Cerro del Meapira, we see the mountain currents run on one side to the Gulf of Paria, and on the other to the Gulf of Cariaco. To the east and west of the ridge there are low and marshy grounds, which spread out without interruption; and if it be admitted, that both gulfs owe their origin to the sinking down of the earth, and rents caused by earthquakes, we must suppose, that the Cerro de Meapira has resisted the convulsive movements of the globe, and hindered the waters of the Gulf of Paria from uniting with those of the Gulf of Cariaco. Without

* See vol. ii, p. 262.

† Near Guira and Carupano.

this rocky dyke, the isthmus itself in all probability would not exist. From the castle of Araya as far as Cape Paria, the whole mass of the mountains of the coast would form a narrow island, parallel to the island of Santa Margaretta, and four times as long. It is not only the inspection of the ground, and considerations drawn from it's *relievo*, which confirm these assertions: a simple view of the configuration of the coasts, and a geological map of the country, would excite the same ideas. It appears, that the island of Margaretta has been heretofore contiguous to the coast chain of Araya, by the peninsula of Chacopata, and the Carribbee islands, Lobo and Coche, in the same manner as this chain is still to that of Cocollar and Caripe by the ridge of Meapira.

In the present state of things, we see the humid places, which stretch themselves to the east and west of the ridge, and which bear the improper names of the vallies San Bonifacio and Cariaco, enlarge themselves by gaining on the sea. The waters retire, and these changes of the shore are very remarkable, more particularly on the coast of Cumana. If the level of the soil seem to indicate, that the two gulfs of Cariaco and Paria occupied formerly a much more considerable space, we cannot doubt, that at present the land augments progressively. Near Cumana a battery, which is called *de la*

Bocca, was built in 1791 on the very edge of the sea; in 1799 we saw it very far in land. At the mouth of the Rio Neveri, near the Morro of Nueva Barcelona, the retreat of the waters is still more rapid. This local phenomenon is owing probably to the accumulation of sand, the progress of which has not yet been sufficiently examined. Descending the Sierra de Meapira, which forms the isthmus between the plains of San Bonifacio and Cariaco, we find toward the east the great lake of Putacuao, which communicates with the river Areo, and is four or five leagues in diameter. The mountainous lands that surround this basin are known only to the natives. There are seen those great boa serpents, which are known to the Chayma Indians by the name of *guainas*, and to which they fabulously attribute a sting under the tail. On descending the Sierra de Meapira to the west, we find at first a hollow ground *(tierra hueca)* which, during the great earthquakes of 1766, threw out asphaltum enveloped in viscous petroleum; farther on a numberless quantity of hydrosulphurous thermal springs * are seen springing up from the soil; and at length we reach the borders of the lake of Campoma, the exhalations from which contribute to render the

* *El Llano de Aguas calientes*, to the E. N. E. of Cariaco, at the distance of two leagues.

climate of Cariaco unhealthy. The natives think, that the hollow is formed by the ingulfing of the hot springs; and, judging by the sound heard under the feet of the horses, we must conclude, that the subterranean cavities are continued from west to east nearly as far as Casanay, a length of three or four thousand toises. A little river, the Rio Azul, runs through these plains, which are rent into crevices by earthquakes, that have a particular centre of action, and seldom extend themselves as far as Cumana. The waters of the Rio Azul are cold and limpid; they arise on the western bank of the mountain of Meapira; and it is believed, that they are augmented by infiltrations from the lake Putacuao, which is situate on the other side of the chain. The latter river and the hydrosulphurous hotsprings fall into the Laguna de Campoma together. This is a name given to a great meer, which is divided in dry weather into three basins situate to the north-west of the town of Cariaco, near the extremity of the Gulf. Fetid exhalations arise continually from the stagnant water of this meer. The smell of sulphuretted hydrogen is mingled with that of putrid fishes, and rotting plants.

Miasmata are formed in the valley of Cariaco, as in the Campagna di Roma; but the heat of the climate of the tropics increases their deleterious energy. These miasmata are proba-

bly ternary or quaternary combinations of azot, phosphorus, hydrogen, carbon, and sulphur. A five-hundredth part of sulphuretted hydrogen mixed with atmospheric air is sufficient, to asphyxiate a dog; and the present state of eudiometry does not afford us means of appreciating gaseous mixtures, which are more or less hurtful to health, according as the elements in infinitely small quantities combine in different proportions. One of the most important services, that modern chemistry has rendered to physiology, is it's having taught us, that we are still ignorant of what illusory experiments on the chemical composition and salubrity of the atmosphere had led us to admit fifteen years ago.

The situation of the Laguna of Campoma renders the north-west wind, which blows frequently after sunset, very pernicious to the inhabitants of the little town of Cariaco. It's influence can be the less doubted, as intermitting fevers are seen to degenerate into typhoid fevers, in proportion as we approach the Laguna, which is the principal focus of putrid miasmata. Whole families of free negroes, who have small plantations on the northern coast of the Gulf of Cariaco, languish in their hammocks from the beginning of the rainy season. These intermittent fevers assume a dangerous character, when persons, debilitated by long labour and

copious perspiration, expose themselves to the fine rains, that frequently fall toward the evening. Nevertheless the men of colour, and particularly the Creole Negroes, resist much better than any other race the influence of the climate. Lemonade and infusions of *scoparia dulcis* are given to the sick; but the *cuspare*, which is the cinchona of Angustura, is seldom used.

It is generally observed, that in these epidemics of the town of Cariaco the mortality is less considerable than might be supposed. Intermitting fevers, when they attack the same individual during several successive years, alter and weaken the constitution; but this state of debility, so common on the unhealthy coasts, does not cause death. What is remarkable enough is the belief, that prevails here as in the Campagna di Roma, that the air is become progressively more vitiated, as a greater number of acres have been cultivated. The miasmata, which these plains exhale, have however nothing in common with those, which arise from a forest when the trees are cut down, and the sun heats a thick layer of dead leaves. Near Cariaco the country is naked, and little woody. Can it be supposed, that the mould *

* If this action be noxious, it certainly does not consist solely in that process of disoxydation, which I have demo-

fresh stirred, and moistened by rains, alters and vitiates the atmosphere more than that thick wood of plants, which covers an uncultivated soil? To these local causes are joined other causes less problematic. The neighbouring borders of the sea are covered with mangroves, avicennias, and other shrubs with astringent bark. All the inhabitants of the tropics are acquainted with the noxious exhalations of these plants; and they dread them so much the more, as their roots and stocks are not always under water, but alternately wetted and exposed to the heat of the sun*. The mangroves produce

strated by numerous experiments on the *humus* and earth of a dark colour (carburetted). It is perhaps at the time that this absorption of oxygen takes place, and in consequence of it, that, according to the complicated action of affinities, these deleterious gaseous combinations with a double or triple basis are formed.

* The creoles comprehend the two genera, rhizophora and avicennia, under the name of mangrove, distinguishing them by the epithets *colorado* and *prieto*. The following is a catalogue of the *social* plants, that cover those sandy plains on the seaside, and characterize the vegetation of Cumana and the Gulf of Cariaco. Rhizophora mangle, avicennia nitida, gomphrena flara, g. *brachiata*, sesuvium portulacastrum (*vidrio*), talinum cuspidatum (*vicho*), t. cumanense, portulacca *pilosa* (*sargoso*), p. lanuginossa, illecebrum *maritimum*, atriplex *cristata*, heliotropium viride, h. latifolium, verbena *cuneata*, mollugo verticillata, euphorbia *maritima*, convolvulus cumanensis. These geographical sketches of vegetation were traced on the spot, by entering in a journal under

miasmata, because they contain, as I have observed elsewhere, vegeto-animal matter combined with tannin. It is said, that it would not be difficult to widen the canal, by which the lake of Campoma communicates with the sea, and give thereby an outlet to the stagnant waters. The free Negroes, who often visit these marshy lands, affirm, that this drain scarcely requires to be deep, because the cold and limpid waters of the Rio Azul are found at the bottom of the lake, so that water drawn up from the lower strata is potable and without smell.

The town of Cariaco has been repeatedly sacked in former times by the Caribs. It's population has augmented rapidly, since the provincial authorities, in spite of the prohibitory orders of the court of Madrid, have often favoured the trade with foreign colonies. The population has doubled in ten years; and amounted, in 1800, to more than 6000 souls. The inhabitants are active in the cultivation of cotton, which is of a very fine quality, and the

distinct numbers the plants of our herbals, which we subsequently ascertained. I think, that this method may be recommended to travellers: it contributes to make known the aspect of a country, upon which the catalogues designated by the vague term of *Floras* instruct us but very imperfectly, because they comprehend at once all kinds of soil.

produce of which exceeds 10,000 quintals *. The capsules of the cotton tree, when the wool has been separated, are carefully burnt; as those husks, if thrown into the river, and exposed to putrefaction, yield exhalations, which are thought very noxious. The culture of the cacao-tree has of late considerably diminished. This valuable tree bears only after eight or ten years. It's fruit keeps very badly in the warehouses, and becomes mouldy at the end of a year, notwithstanding all the precautions employed for drying it. This is a great disadvantage to the planter. On these coasts commerce with neutrals is sometimes prohibited, sometimes permitted under certain restrictions, according to the caprice of the ministry of Madrid, and the greater or less courageous resistance of the governors. The demands for the same kind of merchandize, and the prices, which are regulated by the frequency of these demands, undergo consequently the most sudden variations. The planter cannot take advantage of these variations, because the cacao does not keep in the warehouses. Thus the old trunks

* Nouv. Esp., T. ii, p. 745. The exportation of cotton in 1800 from the two provinces of Cumana and Barcelona amounted to 18,000 quintals; the port of Cariaco alone furnishing six or seven thousand. In 1792 the total exportation was only 3900. The mean price of the quintal is from eight to ten piastres.

of the cacao-trees, which do not bear in general after they have stood 40 years, have not been replaced. In 1792 it was reputed, that there were still 254,000 in the valley of Cariaco and on the borders of the Gulf. At present other branches of culture are preferred, which yield a profit the first year, and the produce of which, while less slow, is of a less uncertain preservation. Such are cotton and sugar, which, not being subject to spoil like the cacao, may be kept, in order to take advantage of all the variations of sale. The changes, which civilization and intercourse with foreigners have introduced in the manners and characters of the inhabitants of the coast, have an influence on the marked preference, which they give to different branches of agriculture. That moderation of desires; that patience, which endures long expectation; that calmness, which supports the dull monotony of solitude; are gradually lost in the character of the Spanish Americans. More enterprising, more light and active, they prefer undertakings, the result of which is most speedy.

It is only in the interior of the province, to the east of the Sierra de Meapira, in that uncultivated country which extends from Curupano, by the valley of San Bonifacio toward the Gulf of Paria, that new plantations of the cacao-tree arise. They become there the more productive, as the

lands, newly cleared and surrounded by forests, are in contact with an atmosphere more damp, more stagnant, and more loaded with mephitic exhalations. We there see fathers of families, attached to the old habits of the planters, prepare for themselves and their children a slow and secure fortune. A single slave is sufficient, to help them in their toilsome labours. They clear the soil with their own hands; raise young cacao-trees under the shade of the erythrinas or plantains; lop the grown trees; destroy the swarm of worms and insects, that attack the bark, the leaves, and the flowers; dig trenches; and resolve to lead a wretched life for seven or eight years, till the cacao-trees begin to bear. Thirty thousand trees secure competence to a family for a generation and a half. If the culture of cotton and coffee have led to the diminution of that of cacao in the province of Caraccas, and in the small valley of Cariaco, it must be confessed, that this last branch of colonial industry has in general increased in the interior of the provinces of New Barcelona and Cumana*. The causes of the progressive march of the cacao-trees from west to east may be easily conceived. The province of Caraccas is the most anciently cultivated: and, under the torrid zone,

* Informe del Tesorero Don Manuel Navarete, sobre el projectado estanco de aguardiente de canna, 1792 (manuscript).

in proportion as a country is longer cleared, it becomes more denuded of trees, drier, and more exposed to the winds. These physical changes are adverse to the production of cacao-trees. Thus the plantations, diminishing in the province of Caraccas, accumulate in some sort toward the east, on a newly cleared and virgin soil. New Andalusia alone produced in 1799 from eighteen to twenty thousand *fanegas* of cacao, at forty piastres the *fanega* in time of peace, five thousand of which* were smuggled to the island of Trinidad. The cacao of Cumana is infinitely superior to that of Guayaquil. The best is produced in the valley of San Bonifacio; as the best cacao of New Barcelona, Caraccas, and Guatimala, is that of Capiriqual, Uritucu, and Soconusco.

We had to regret, that the fevers prevalent at Cariaco hindered us from prolonging our stay there; we were not yet sufficiently seasoned, and the planters themselves, to whom we

* The places where the culture is the most abundant are the valleys of Rio Carives, Carupano, Irapa, celebrated for it's thermal waters, Chaguarama, Cumacatar, Caratar, Santa Rosalia, San Bonifacio, Rio Seco, Santa Isabela, Patucutal. In 1792, in all this space they reckoned only four hundred and twenty-eight thousand cacao-trees: in 1799, there were, from official documents, that I procured, near a million and a half. The fanega of cacao weighs one hundred and ten pounds.

had recommendations, advised us to depart. We found in this town a great number of persons, who, by a certain ease in their manners, enlargement of their ideas, and, I must add, by a marked predilection for the government of the United States, discovered, that they had held frequent intercourse with foreigners. There, for the first time in these climates, we heard the names of Franklin and Washington pronounced with enthusiasm. The expressions of this enthusiasm were mingled with complaints on the actual state of New Andalusia; the enumeration, often exaggerated, of it's natural riches; and ardent and anxious wishes, that happier times might arrive. This disposition of mind was striking to a traveller, who had just witnessed, and so near, the great agitations of Europe. It foreboded, as yet, nothing hostile and violent, no determinate direction. There was that degree of vagueness in the ideas and the expressions, which characterises in nations, as in individuals, a state of half cultivation, an immature display of civilization. Since the Island of Trinidad has become an English colony, the whole of the eastern extremity of the province of Cumana, especially the coast of Paria, and the Gulf of the same name, have changed their appearance. Strangers have settled there, and have introduced the cultivation of the coffee-tree, the cotton-tree, and the

sugar-cane of Otaheite. The population has greatly increased at Carupano, in the beautiful valley of Rio Caripe, at Guira, and at the new town of Punta di Piedra, built opposite Spanish Harbour, in the island of Trinidad. The soil is so fertile in the Golfo Triste, that the maize yields two harvests in the year, and produces three hundred and eighty times the quantity sown*. The isolated situation of the settlements has favored the trade with foreign colonies; and from the year 1797 a revolution has taken place in the ideas of the people, the consequences of which would have been long in proving fatal to the metropolis, if the ministry had not continued to thwart all their interests, and oppose all their wishes. There is a period in the contentions with colonies, as in almost all popular commotions, when governments, if they be not blind respecting the course of human affairs, may, by a wise and provident moderation, reëstablish the equilibrium, and avert the storm. If they fail to seize this period, if they fancy they can oppose a moral tendency by physical force, events unfold themselves irresistibly, and the separation of the colonies is effected by a violence, that is but so much the more fatal, if the mother-country have succeeded during the struggle, in reëstablishing for a

* One *almuda* produces in the *Golfo Triste*, 32 *fanegas*; at Cariaco, 25.

time it's monopolies, and it's ancient domination.

We embarked early in the morning in hopes of crossing the Gulf of Cariaco in the day. The motion of the waters resembles that of our great lakes, when they are gently agitated by the winds. There are only twelve nautical leagues from the place of embarkation to Cumana. On quitting the small town of Cariaco, we proceeded westward along the river of Carenicuar, which, in a straight line like an artificial canal, leads through gardens and plantations of cotton-trees. The whole of this ground, a little marshy, is cultivated with the greatest care. During our abode in Peru, the cultivation of the coffee-tree was introduced in the driest spots. We saw the Indian women washing their linen, along the river of Cariaco, with the fruit of the parapara (sapindus saponaria). This operation is said to be very injurious to the fine linen. The bark of the fruit produces much scum; and the fruit is so elastic, that thrown on a stone, it bounds three or four times to the height of seven or eight feet. Being of a spherical form, it is employed in making rosaries.

We were scarcely embarked, when we had to struggle against contrary winds. The rain came down in torrents, and the thunder rolled very near. Swarms of flamingoes, egrets, and cormorants filled the air, seeking the shore.

The alcatras, a large species of pelican, alone continued peaceably to fish in the middle of the Gulf. There were eighteen passengers of us; and we had much difficulty to find room for our instruments and collections in a narrow canoe*, overloaded as it was with raw sugar, plantains, and cocoa-nuts. The water was up to the boat's gunwale. The Gulf of Cariaco is almost every where forty-five or fifty fathoms deep; but at it's eastern extremity, near Curaguaca, for an extent of five leagues, the lead does not indicate more than three or four fathoms. Here is found the *baxo de la Cotua*, a sand-bank, which at low water appears like a small island. The canoes that carry provision to Cumana sometimes ground on this bank; but always without danger, because the sea there is never rough or heavy. We crossed that part of the Gulf, where hot springs gush from the bottom of the sea. It was the time of flood, so that the change of temperature was less perceptible: besides, our canoe drove too much toward the southern shore. It may be supposed, that strata of water must be found of different temperatures, according to the greater or less depth, and according as the mixture of the hot waters with those of the Gulf is accelerated by the winds and currents. The

* Lancha.

existence of these hot springs, which we were assured raise the temperature of the sea through an extent of ten or twelve thousand square toises, is a very remarkable phenomenon*. On proceeding from the promontory of Paria toward the west, by Irapa, Aquas Calientes, the Gulf of Cariaco, the Brigantine, and the valleys of Aragua, as far as the snowy mountains of Merida, a continued band of thermal waters is found in an extent of 150 leagues.

The contrary winds and rainy weather forced us to go on shore at Pericantral, a small farm situate on the south side of the gulf. The whole of this coast, covered with beautiful vegetation, is almost without cultivation. There are scarcely seven hundred inhabitants: and, except the village of Mariguitar†, we saw only plantations of cocoa-trees, which are the olives of the country. This palm-tree occupies on both continents a zone, of which the mean tem-

* In the island of Guadaloupe, there is a fountain of boiling water, that rushes out on the beach (Lescalier, *Journ. de Physique*, tom. 67, p. 379). Springs of hot water rise from the bottom of the sea in the Gulf of Naples, and near the Island of Palma, in the archipelago of the Canary Islands.

† The Geographical Atlas of Raynal indicates, between Cariaco and Cumana, a town called Verina, that never existed. The most recent maps of America are loaded with names of places, rivers, and mountains, without it's being possible to discover the source of these errors, which are handed down from age to age.

perature of the year is not below 30°*. It is, like the chamærops of the basin of the Mediterranean, a true palm-tree of the coast. It prefers salt to fresh waters; and flourishes less inland, where the air is not loaded with saline particles, than on the coasts. When cocoa-trees are planted in Terra Firma, or in the Missions of the Oronoko, at a distance from the sea, a considerable quantity of salt, sometimes as much as half a bushel, is thrown into the hole that receives the cocoa-nut. Among the plants cultivated by man, the sugar-cane, the plantain, the mammee-apple, and alligator-pear (laurus persea), alone have the property of the cocoa-tree; that of being watered alike with fresh and salt water. This circumstance is favourable to their migrations; and if the sugar-cane of the shore yield a sirup that is a little brackish, it is believed at the same time to be better fitted for the distillation of spirit, than the juice produced from the canes in the interior.

The cocoa-tree, in the rest of America, is in general cultivated around farm-houses, to be eaten as fruit; in the Gulf of Cariaco, it forms real plantations. At Cumana, they talk of a

* The cocoa-tree grows in the northern hemisphere from the equator to the latitude of 28°. Near the equator we find it from the plains to 700 toises of elevation above the level of the sea.

hacienda de coco, as of a *hacienda de canna* or *de cacao*. In a fertile and moist ground, the cocoa-tree begins to bear fruit in abundance the fourth year; but in dry soils it yields produce at the end of ten years only. The duration of the tree does not in general exceed eighty or a hundred years; and it's mean height at this period is from seventy to eighty feet. This rapid growth is so much the more remarkable, as other palm-trees, for instance, the *moriche* *, and the palm of Sombrero †, the longevity of which is very great, frequently do not reach above fourteen or eighteen feet in sixty years. In the first thirty or forty years, a cocoa-tree of the Gulf of Cariaco bears every lunation a cluster of ten or fourteen nuts, all of which however do not ripen. It may be reckoned, that, on an average, a tree produces annually a hundred nuts, which yield eight *flascos* ‡ of oil. The flasco is sold for two rials and a half of plate, or sixteen pence. In Provence, an olive-tree thirty years old yields twenty pounds, or seven flascoes of oil, so that it produces something less than a cocoa-tree. There are in the Gulf of Cariaco *haciendas* of eight or nine thousand cocoa-trees. They resemble, in their pic-

* Mauritia flexuosa.

† Corypha tectorum.

‡ One *flasco* contains 70 or 80 cubic inches, Paris measure.

turesque appearance, those fine plantations of date-trees, near Elche, in Murcia, where in one square league are found upwards of 70,000 palms. The cocoa-tree bears fruit in abundance till it is thirty or forty years old; after this age, the produce diminishes, and a trunk a hundred years old, without being altogether barren, yields very little produce. In the town of Cumana a great quantity of oil of cocoas is made, which is limpid, without smell, and very fit for burning. The trade in this oil is not less brisk than that on the coast of Africa for palm oil, which is obtained from the elays guineensis, and is used as food. At Cumana I have often witnessed the arrival of canoes laden with 3000 cocoa-nuts. A tree in full bearing yields an annual revenue of two piastres and half (eleven shillings and tenpence halfpenny). But in the *haciendas* of cocoa, trees of different ages being mixed, the capital * is estimated by appraisers only at four piastres.

* These valuations may serve to throw some light on the advantages derived from the culture of fruit-trees under the torrid zone. Near Cumana, a banana is valued by estimation at one *real de plata* ($6\frac{1}{2}d.$). A *nispero*, or sapota, at 10 piastres. Four cocoa-nuts, or eight fruits of the *nispero* (achras sapota), are sold for half a real. The price of the former has doubled within these twenty years, on account of the great exportation that has been made to the islands. A good bearing *nispero* yields the farmer, who can sell the

We did not quit the farm of Pericantral till after sunset. The south coast of the Gulf, covered with a rich vegetation, presents the most agreeable aspect, while the northern coast is naked, dry, and rocky. In spite of this aridity, and the failure of rain, which is sometimes felt for fifteen months *, the peninsula of Araya, like the desert of Canound in India, produces *patillas,* or water melons, that weigh from fifty to seventy pounds. Under the torrid zone, the vapors contained by the air form about nine tenths of the quantity necessary to it's saturation; and vegetation is maintained by the ad-

fruit in a neighbouring town, near eight piastres a year; a bixa [annotta tree] or a pomegranate tree yields only one piastre. The pomegranate is much sought after on account of the refreshing juice of it's fruit, which is preferred to those of the passiflora or *parcha.*

* The rains appear to have been more frequent at the beginning of the 16th century. At least the Canon of Granada, *Petrus Martyr d'Anghiera* (*De Reb. Ocean.*, Coloniæ, 1574, p. 93), speaking of the salt-works of Araya, or of *Haraia,* which we have described in the fifth Chapter, mentions showers (*cadentes imbres*) as a very common phenomenon. The same author, who died in 1526 (Cancelieri, Notizie di Columbo, p. 212), affirms, that the Indians wrought the salt works before the arrival of the Spaniards. They dried the salt in form of bricks, and Petrus Martyr even then discussed the geological question, whether the clayey soil of Haraia contained salt springs, or whether it had been impregnated with salt by the periodical inundations of the ocean for ages.

mirable property, which the leaves possess, of attracting the water dissolved in the atmosphere. We passed a very indifferent night in a narrow and deeply laden canoe; and reached the mouth of the river Mançanares at three in the morning. Accustomed for several weeks past to the aspect of mountains, to a stormy sky, and to gloomy forests, we were struck with the invariable clearness of the air, the nakedness of the soil, and the mass of reflected light, which characterize the site of Cumana.

At sunrise, we saw the *zamuro* vultures *, in flocks of forty or fifty, perched on the cocoa-trees. These birds range themselves in files to sleep together like fowls; and their indolence is such, that they go to roost long before sunset, and awake not till after the sun is above the horizon. This idleness seems as if it were shared in those climates by the trees with pennate leaves. The mimosas and the tamarinds close their leaves in a clear and serene sky, twenty-five or thirty-five minutes before the setting of the sun, and unfold them in the morning when it's disk has been visible for the same time. As I noticed pretty regularly the setting and rising of the sun, in order to observe the effect of the *mirage*, or of the terrestrial refractions, I was enabled to give continu-

* Vultur oura.

ed attention to the phenomenon of the sleep of plants. I found them the same in the *steppes*, where no irregularity of the ground interrupted the view of the horizon. It appears, that, accustomed during the day to an extreme brilliancy of light, the sensitive and other leguminous plants with thin and delicate leaves are affected in the evening by the smallest decline in the intensity of the sun's rays; so that night begins for the vegetables, there as with us, before the total disappearance of the solar disk. But why, under a zone where there is scarcely any twilight, do not the first rays of the sun stimulate the leaves with so much more force, as the absence of light must have rendered them more irritable? Does the humidity deposited on the parenchyma by the cooling of the leaves, which is the effect of the nocturnal radiation, prevent perhaps the action of the first rays of the Sun? In our climates, the leguminous plants with irritable leaves awake during the twilight of the morning, before the sun appears.

CHAPTER IX.

Physical Constitution and Manners of the Chaymas.—Their Languages.—Filiation of the Nations which inhabit New Andalusia.—Pariagotoes seen by Columbus.

I was unwilling to mingle with the narrative of our journey to the Missions of Caripe general considerations on the different tribes of natives, that inhabit New Andalusia; on their manners, their languages, and their common origin. Having returned to the spot from which we set out, I shall now bring into one point of view these objects, which are so nearly connected with the history of the human race. As we advance into the interior of the country, these subjects will become more interesting than the phenomena of the physical world. The north-east part of equinoctial America, Terra Firma, and the shore of the Oroonoko, resemble, with respect to the multiplicity of the nations that inhabit them, the defiles of Caucasus, the mountains of Hindoo-kho, at the northern extremity of Asia, beyond the Tungooses, and the

Tatars settled at the mouth of the Lena. The barbarism that prevails throughout these different regions is perhaps less owing to a primitive absence of all kind of civilization, than to the effects of a long degradation. The greater part of the hordes, which we designate under the name of savages, descend probably from nations more advanced in cultivation; and how can we distinguish the prolonged infancy of the human race, if indeed it any where exists, from that state of moral degradation in which solitariness, want, compulsory misery, forced migrations, or the rigour of the climate, obliterate even the traces of civilization? If every thing which is connected with the primitive state of man, and the first population of a continent, could from it's nature belong to the domain of history, we should appeal to the traditions of India, to that opinion so often expressed in the laws of Menou and in the Ramajan, which considers savages as tribes banished from civil society, and driven into the forests. The word *barbarous*, which we have borrowed from the Greeks and the Romans, is perhaps only the particular name of one of these rude hordes*.

In the New World, at the beginning of it's

* The Varvaras, the Palawas, the Sakas, the Jawanas, the Kambodschas, the Tschinas. Wilkins, Heetopad., p. 310. Bopp, on the Grammatical System of the Sanscrit, the Greek, the Latin, and the Gothic (in German), 1816, p. 177.

conquest, the natives were collected into large societies only on the ridge of the Cordilleras, and the coasts opposite to Asia. The plains, covered with forests, and intersected by rivers; the immense savannahs, that extend toward the east, and bound the horizon; presented to the eye of the spectator wandering hordes, separated by the difference of language and manners, and scattered like the remains of a vast shipwreck. In the absence of all other documents, we will try whether the analogy of languages, and the study of the physical constitution of man, will enable us to group the different tribes, to follow the traces of their distant emigrations, and to discover some of those family features, by which the ancient unity of our species is manifested.

In the country, the mountains of which we have just traversed, and in the two provinces of Cumana and New Barcelona, the natives, or primitive inhabitants, still constitute half of the scanty population. Their number may be reckoned at sixty thousand; of which twenty-four thousand inhabit New Andalusia. This number is very considerable, if it be compared to that of the hunting nations of North America; but appears small, when we consider those parts of New Spain, in which agriculture has existed more than eight centuries: for instance, the intendance of Oaxaca, which includes the

Mixteca and the Tzapoteca of the old Mexican empire. This intendance is one third smaller than the two provinces of Cumana and Barcelona *; yet it contains more than four hundred thousand natives of the pure copper coloured race †. The Indians of Cumana do not all live assembled in the Missions. Some are found dispersed in the neighbourhood of towns, along the coasts, to which they are attracted by the fisheries, and even in the little farms of the plains or savannahs. The Missions of the Arragonese Capuchins, which we visited, alone contain fifteen thousand Indians, almost all of the Chayma race. The villages however are less populous there, than in the province of Barcelona. Their average population is only between five or six hundred Indians; while more to the west, in the Missions of the Franciscans of Piritoo, we find Indian villages of two or three thousand inhabitants. In computing at sixty thousand the number of the natives in the provinces of Cumana and Barcelona, I have considered only those who inhabit the main land, and not the Guayquerias of the Island of Margaretta, and the great mass of the Guaraounoes, who have preserved their independence in

* The area of the two provinces is 6100 square leagues, of 25 to a degree.

† *Nouv. Esp.*, T. i, p. 77, and 262.

the islands formed by the Delta of the Oroonoko. The number of these is generally reckoned at six or eight thousand; but this computation appears to me to be exaggerated. Except a few families of Guaraounoes, that roam occasionally in the marshy grounds * covered with the *moriche* palm, between the Cano de Manamo and the Guarapiche, consequently on the continent itself, there have not been for these thirty years any Indian savages in New Andalusia.

I use with regret the word *savage*, because it indicates a difference of cultivation between the *reduced* Indian, living in the Missions, and the free or independent Indian, which is often belied by facts. In the forests of South America exist tribes of natives, who, peaceably united in villages, obey chiefs †, cultivate the plaintain-tree, cassava, and cotton on a pretty extensive portion of ground, and employ this last in weaving hammocks. These people are scarcely more barbarous than the naked Indians of the Missions, who have been taught to make the sign of the cross. It is a very common error in Europe, to look on all the natives not reduced to a state of subjection, as roving hunters. Agriculture existed on the continent long before the arrival of the Europeans. It still exists be-

* *Los Morichales.*

† These chiefs are called *pecanati*, *apoto*, or *sibierene*.

tween the Oroonoko and the river of Amazons, in open land amid the forests, to which the missionaries have never penetrated. What has been effected by the system of the Missions is an increased attachment to landed property, the stability of dwellings, and a taste for a more calm and tranquil life. The progress however is slow, and often imperceptible, on account of the perfectly isolated state, in which the Indians are held. But it would be to imbibe false ideas on the actual condition of the nations of South America, to consider as synonimous the denominations of *Christians, reduced*, and *civilized*; and those of *pagans, savages*, and *independent*. The reduced Indian is often as little of a christian, as the independent Indian is of an idolater; both, occupied by the wants of the moment, discover a marked indifference for religious opinions, and a secret tendency toward the worship of Nature and it's powers. This worship belongs to the earliest infancy of nations; it excludes idols, and recognizes no other sacred places, than grottoes, valleys, and woods.

If the independent Indians have nearly disappeared for a century past to the north of the Oroonoko and the Apura, that is from the snowy mountains of Merida to the promontory of Paria, it must not thence be concluded, that fewer natives exist at present in those countries, than

in the time of the Bishop of Chiapa, Bartholomew de las Casas. I have already proved, in my work on Mexico, the magnitude of the error of presenting as a general fact the destruction and diminution of the Indians in the Spanish Colonies*. There still exist more than six millions of the copper-coloured race, in both Americas; and, though an innumerable quantity of tribes and of languages are extinguished, or confounded together, it is beyond a doubt, that within the tropics, in that part of the New World where civilization has penetrated only since the time of Columbus, the number of natives has considerably increased. Two villages of Caribs, in the Missions of Piritoo or of Carony, contain more families than four or five hordes on the Oroonoko. The state of society among the Caribbees, who have preserved their independence, at the sources of the Esquibo, and to the south of the mountians of Pacaraimo, sufficiently proves, how much, even among that fine race of men, the population of the Missions prevails in number over that of the free and confederated Caribbees. Besides, the state of the savages of the torrid zone is not the same as that of the savages of the Missouri. The latter have need of a vast extent of country, because they live only by hunting;

* *Es cosa constante irse disminuyendo por todas partes el numero de los Indios.* (Ulloa, *Noticias Amer.*, 1772, p. 341).

while the Indians of Spanish Guiana plant cassava and plaintains. A little ground suffices these, to supply them with food. They do not dread the approach of the whites, like the savages of the United States; who, progressively pushed behind the Alleghàny mountains, the Ohio, and the Missisippi, lose their means of subsistence, in proportion as they find themselves reduced within narrower limits. Under the temperate zone, whether in the *provincias internas* of Mexico, or in Kentucky, the contact of the European planters is become fatal to the natives, because that contact is immediate.

These causes have no existence in the greater part of South America. Agriculture, under the tropics, does not require great extent of ground. The whites advance slowly. The religious orders have founded their establishments between the domain of the planters, and the territory of the free Indians. The Missions may be considered as intermediary states. They have encroached on the liberty of the natives no doubt; but they have almost every where been advantageous to the increase of population, which is incompatible with the unquiet life of the independent Indians. As the Missionaries advance toward the forests, and gain on the natives, the white planters in their turn seek to invade from the opposite side the territory of the Missions. In this protracted struggle, the

secular arm continually tends to withdraw the reduced Indian from the monastic hierarchy, and the missionaries gradually give way to vicars. The whites, and the casts of mixed blood, favoured by the corregidors, establish themselves among the Indians. The Missions become Spanish villages, and the natives lose even the remembrance of their natural idiom. Such is the progress of civilization from the coasts toward the interior; a slow progress, shackled by the passions of man, but sure, and uniform.

The provinces of New Andalusia and Barcelona, comprehended under the name of *Govierno de Cumana*, contain, in their present population, more than fourteen tribes. Those in New Andalusia are the Chaymas, Guayquerias, Pariagotoes, Quaquas, Aruacas, Caribbees, and Guaraounoes; in the province of Barcelona, Cumanagotoes, Palenkas, Caribbees, Piritoos, Tomoozas, Topocuares, Chacopatas, and Guarivas. Nine or ten of these fourteen tribes consider themselves as of a race entirely different. The exact number of the Guaraounoes, who make their huts on the trees at the mouth of the Oroonoko, is unknown; that of the Guayquerias, in the suburbs of Cumana and in the peninsula of Araya, amounts to two thousand. Among the other Indian tribes, the Chaymas of the mountains of Caripe, the Caribs of the south-

ern savannahs of New Barcelona, and the Cumanagatoes in the Missions of Piritoo, are the most numerous. Some families of Guaraounoes have been reduced into Missions on the left bank of the Oroonoko, where the Delta begins to be formed. The language of the Guaraounoes and that of the Caribs, of the Cumanagotoes and of the Chaymas, are the most general. We shall presently see, that they seem to belong to the same stock; and that they exhibit in their grammatical forms those intimate affinities, which, to use a comparison taken from languages more known, connect the Greek, the German, the Persian, and the Sanscrit.

Notwithstanding these affinities, we must consider the Chaymas, the Guaraounoés, the Caribbees, the Quaquas, the Aruacas or Arrawawks, and the Cumanagotoes, as different nations. I would not venture to affirm the same thing of the Guayquerias, the Pariagotocs, the Piritoos, the Tomoozas, and the Chacopatas. The Guayquerias themselves admit the analogy of their language with that of the Guaraounoes. Both are a littoral race, like the Malays of the ancient continent. With respect to the tribes who at present speak the Cumanagoto, Caribbean, and Chayma idioms, it is difficult to decide on their first origin, and their relations with other nations formerly more powerful. The historians of the Conquest, like the eccle-

siastics who have described the progress of the Missions, continually confound, like the ancients, *geographical denominations* with the names of races. They speak of Indians of Cumana and of the coast of Paria, as if the proximity of abode proved the identity of origin. They most commonly even give to tribes the name of their chief, or that of the mountain or valley they inhabit. This circumstance, by infinitely multiplying the number of tribes, renders every thing uncertain, that the monks relate respecting the heterogeneous elements of which the population of their Missions are composed. How can we at present decide, whether the Tomooza and Piritoo be of different races, when both speak the Cumanagoto language, which is the prevailing tongue in the western part of the Govierno of Cumana; as the Caribbean and the Chayma are in the southern and eastern parts. A great analogy of physical constitution renders these researches very difficult. Such is the contrast between the two continents, that in the new a surprising variety of languages is observed among nations of the same origin, and which European travellers scarcely distinguish by their features; while in the old continent very different races of men, the Laplanders, the Finlanders, and the Esthonians, the German nations and the Hindoos, the Persians and the Curds, the Tatar and Mun-

gal tribes, speak languages, the mechanism and roots of which present the greatest analogy.

The Indians of the American Missions are all agriculturists; and excepting those, who inhabit the high mountains, they cultivate the same plants; their huts are arranged in the same manner; their days of labour, their work in the *conuco* of the community, their connexions with the missionaries and the magistrates chosen from among themselves, are all subjected to uniform regulations. Nevertheless, and this fact is very remarkable in the history of nations, so great an analogy of situation has not been sufficient to efface the individual features, or the shades which distinguish the American tribes. We observe in the men of copper hue, a moral inflexibility, a stedfast perseverance in habits and manners, which, though modified in each tribe, characterize essentially the whole race. These dispositions are found under every climate, from the equator to Hudson's Bay on the one hand, and to the streights of Magellan on the other. They are connected with the physical organization of the natives, but they are powerfully favoured by the monastic system.

There exist in the Missions few villages, where the different families do not belong to different tribes, and speak different languages. Societies composed of elements thus heterogeneous

are difficult to govern. In general, the monks have united whole nations, or great portions of the same nations, in villages lying near each other. The natives see only those of their own tribe; for the want of communication, and the isolated state of the people, form the principal policy of the missionaries. The reduced Chaymas, Caribs, and Tamanacs retain so much the more their natural physiognomy, as they have preserved their languages. If the individuality of man be in some sort reflected in his idioms, these in their turn reäct on his ideas and sentiments. It is this intimate connection between the languages, the character, and the physical constitution, which maintains and perpetuates the diversity of nations, that unfailing source of life and motion in the intellectual world.

The missionaries may have prohibited the Indians from following certain practices in use on the birth of children, on their entrance on the age of puberty, and at the interment of the dead: they may have prevented them from painting their skin, from making incisions on their chins, noses, and cheeks; they may have destroyed among the great mass of the people superstitious ideas, which are mysteriously transmitted from father to son in certain families: but it has been easier for them to proscribe customs and efface remembrances, than to substitute

new ideas in the place of the old. The Indian of the Missions is more secure of subsistence. Not being continually struggling against hostile forces, against the elements and against man, he leads a more monotonous life, less active, and less fitted to impart energy to the mind, than the savage or independent Indian. He possesses that mildness of character, which belongs to the love of repose; not that which arises from sensibility and the emotions of the soul. The sphere of his ideas is not enlarged, where, having no intercourse with the whites, he has remained at a distance from those objects, with which European civilization has enriched the New World. All his actions seem prompted by the wants of the moment. Taciturn, without gaiety, absorbed in himself, he assumes a sedate and mysterious air. When a person has resided but a short time in the Missions, and is yet but little familiarized with the aspect of the natives, he is led to mistake their indolence, and the benumbed state of their faculties, for the expression of melancholy, and a disposition toward meditation.

I have dwelt on these features of the Indian character, and on the different modifications which this character undergoes under the government of the missionaries, to render more interesting the partial observations, which are

the subject of this chapter. I shall begin by the nation of the Chaymas, of whom more than fifteen thousand inhabit the Missions that have just been described. This nation, little warlike, which father Francisco of Pamplona* began to reduce to subjection in the middle of the seventeenth century, has the Cumanagotoes toward the west, the Guaraounoes toward the east, and the Caribbees toward the south. It occupies a space along the elevated mountains of the Cocollar and the Guacharo, the banks of the Guarapiche, of the Rio Colorado, of the Areo, and of the Cano of Caripe. According to a statistical survey made with great care by the father Prefect†, there were in the Missions of the Arragonese Capuchins of Cumana—

Nineteen villages of *Missions*, of which the oldest was established in 1728; containing one thousand four hundred and sixty-five families, and six thousand four hundred and thirty-three persons: sixteen villages *de doctrina*, of which the oldest dates in 1660; containing one thousand seven hundred and sixty-six fami-

* The name of this monk, celebrated for his active intrepidity, is still revered in the province. He sowed the first seeds of civilization among these mountains. He had long been captain of a ship; and before he became a monk, bore the name of Tiburtio Redin.

† Fray Francisco de Chiprana (*manuscript memoir*).

lies, and eight thousand one hundred and seventy persons*.

These Missions suffered greatly in 1681, 1697, and 1720, from the invasions of the Caribbees, then independent, who burnt whole villages. From 1730 to 1736, the population diminished from the ravages of the small-pox, a disease always more fatal to the copper-coloured Indians, than to the whites. Many of the Guaraounoes, who had been assembled together, fled back again to their marshes. Fourteen old Missions remained deserted, and have not been rebuilt. The Chaymas are in general short; and they appear so particularly, when compared, I shall not say with their neighbours the Caribbees, or with the Payaguas or Guayquilits† of Paraguay, equally remarkable for their stature, but with the ordinary natives of America. The common stature of a Chayma is 1·57 met. or four feet ten inches [five feet two inches nearly], their body is thick set, shoulders extremely broad, and breast flat.

* Cultivated land (*labranzas*), belonging to these thirty-five villages, 6554 *almudas*. The number of cows in 1792 amounted only to 1883.

† The ordinary stature of the Guayquilits or Mbayas, who live between the 20th and 22d degrees of south latitude, is, according to Azzara 1·84, met. or five feet eight inches [six feet and half an inch Eng.] The Payaguas, equally tall, have given their name to Payaguay, or Paraguay.

All their limbs are round and fleshy. Their colour is that of the whole American race, from the cold table lands of Quito and New Grenada to the burning plains of the Amazons. It is no longer changed by the varied influence of climate; it is connected with organic dispositions, which for ages past have been unalterably transmitted from generation to generation. If the uniform tint of the skin be more coppery and redder toward the north, it is on the contrary among the Chaymas of a dull brown inclining towards tawny. The denomination of *copper coloured* [*rouges-cuivrés*] men could never have originated in equinoxial America to designate the natives.

The expression of the countenance of the Chaymas, without being hard or stern, has something sedate and gloomy; the forehead is small, and but little prominent. Thus in several languages of these countries, to express the beauty of a woman, they say "that she is fat, and has a narrow forehead." The eyes of the Chaymas are black, sunk, and very long: but they are neither so obliquely placed, nor so small, as in the people of the Mongul race, of whom Jornandes says, that they have rather points, than eyes; *magis puncta quam lumina.* The corner of the eye is however sensibly raised up toward the temples; the eyebrows are black, or dark brown, slender, and little arched; the

eyelids are furnished with very long eyelashes, and the habit of casting them down, as if they were lowered by lassitude, softens the look of the women, and makes the eye thus veiled appear less than it really is. If the Chaymas, and in general all the natives of South America and New Spain, resemble the Mongul race, by the form of the eye, their high cheek bones, their straight and flat hair, and the almost entire want of beard; they essentially differ from them in the form of the nose, which is pretty long, prominent throughout it's whole length, and thick toward the nostrils, the openings of which are directed downward, as with all the nations of the Caucasian race. Their wide mouth, with lips but little protuberant though broad, has often an expression of goodness. The passage from the nose to the mouth is marked in both sexes by two furrows, which run diverging from the nostrils toward the corners of the mouth. The chin is extremely short and round; and the jaws are remarkable for their strength and width.

Though the Chaymas have fine white teeth, like all people who lead a very simple life, they are however not so strong as those of the Negroes. The habit of blackening the teeth, from the age of fifteen, by the juices of certain herbs* and caustic lime, had engaged the at-

* The first historians of the conquest attribute this effect

tention of the earliest travellers; but it is at present quite unknown. Such have been the migrations of the different tribes in these countries, particularly since the incursions of the Spaniards, who carried on the slave trade, it may be admitted, that the inhabitants of Paria, visited by Christopher Columbus, and by Ojeda, were not of the same race as the Chaymas. I doubt much, whether the custom of blackening the teeth were originally connected, as Gomara affirmed*, with extravagant ideas of beauty,

to the leaves of a tree, that the natives called *hay*, which resembled the myrtle. Among nations very distant from each other, the pimento bears a similar name; among the Haytians (of the island of St. Domingo) *aji* or *ahi*; among the Maypures of the Oroonoko *a-i*. Some stimulant and aromatic plants, which do not all belong to the genus capsicum, were designated by the same name.

* Cap. 78, p. 101. The nations, that were seen by the Spaniards on the coast of Paria, had probably the custom of stimulating the organs of taste by caustic lime, as others employed tobacco, the chimo, the leaves of the cocca, or betel. This practice is found even in our days, but more toward the west, among the Guajiroes, at the mouth of the Rio la Hacha. These Indians, still savage, carry small shells, calcined and powdered, in the shell of a fruit, that serves them as a vessel for various purposes, suspended to their girdle. The powder of the Guajiroes is an article of commerce, as was anciently, according to Gomara, that of the Indians of Paria. In Europe the immoderate habit of smoking also makes the teeth yellow and blackens them: but would it be just to conclude from this fact, that they

or were practised with the view of preventing the toothach. This disorder is almost unknown to the Indians; the whites even suffer very seldom from it in the Spanish Colonies, at least in the warm regions, where the temperature is so uniform. They are more exposed to it on the back of the Cordilleras, at Santa-Fe, and at Popayan.

The Chaymas, like almost all the native nations I have seen, have small, slender hands. Their feet are large, and their toes retain an extraordinary mobility. All the Chaymas have a family look; and this analogy of form, so often observed by travellers, is so much the more striking, as between the years of twenty and fifty difference of age is no way denoted by wrinkles of the skin, the colour of the hair, or decrepitude of the body. On entering a hut, it is often difficult among adult persons to distinguish the father from the son, and not to confound one generation with another. I attribute this family look to two different causes, the local situation of the Indian tribes, and their inferior degree of intellectual culture. Savage nations are subdivided into an infinity of tribes, which, bearing a cruel hatred toward each other, form no intermarriages, even when their languages spring from the same root,

who smoke with us do it because we think yellow teeth handsomer than white?

and when only a small arm of a river, or a group of hills, separates their habitations. The less numerous are the tribes, the more the intermarriages, repeated for ages, between the same families, tend to fix a certain equality of conformation, an organic type, which may be called national*. This type is preserved under the government of the Missions formed by a single horde. The isolated state is the same, and marriages are contracted only between the inhabitants of the same hamlet. Those ties of blood, which unite almost a whole nation, are indicated in a simple manner in the language of the Indians born in the Mission, or by those, who, taken from the woods, have learned Spanish. To designate the individuals, who belong to the same tribe, they employ the words *mis parientes*, my relations.

These causes, which depend only on the isolated state, and the effects of which are found among the Jews of Europe, among the different casts of India, and among mountaineer nations in general, are connected with causes hitherto neglected. I have observed elsewhere, that it is intellectual culture which contributes most to diversify the features. Barbarous nations have

* Nullis aliis aliarum nationum connubiis infecta, propria et sincera, et tantum sui similis gens. Unde habitus quoque corporum, quamquam in tanto hominum numero, idem omnibus. Tac. Germ. c. 4.

rather a physiognomy of tribe or horde, than one peculiar to such or such an individual. The savage and civilized man are like those animals of the same species, several of which rove in the forest, while others, connected with us, share in the benefit and evils that accompany civilization. The varieties of form and colour are frequent only in domestic animals. How great is the difference, with respect to mobility of features and variety of physiognomy, between dogs again become savage in the New World, and those the slightest caprices of which are indulged in the houses of the opulent! Both in men and animals the emotions of the soul are reflected in the features; and the features acquire the habit of mobility, in proportion as the emotions of the mind are more frequent, more varied, and more durable. But the Indian of the Missions, distant from all cultivation, guided only by his physical wants, satisfying almost without difficulty his desires, under a happy climate, drags on a dull monotonous life. The greatest equality reigns among the members of the same community; and this uniformity, this invariableness of situation, is pictured on the features of the Indians.

Under the system of the monks, violent passions, such as resentment and anger, agitate the native more rarely than when he lives in the forest. If the savage man give himself up

to impetuous and quick emotions; his physiognomy, till then calm and motionless, changes instantly to convulsive contortions. His passion is transient in proportion to it's violence. With the Indians of the Missions, as I have often observed on the Oroonoko, anger is less furious, less frank, but of longer duration. Besides, in every condition of man, it is not the energy or the transient bursts of the passions, which give expression to the features; it is rather that sensibility of the soul, which brings us continually into contact with the external world, multiplies our sufferings and our pleasures, and reäcts at once on the physiognomy, the manners, and the language. If the variety and mobility of the features embellish the domain of animated nature, we must admit also, that both increase by civilization, without being produced by it alone. In the great family of nations, no other race unites these advantages to a higher degree than that of Caucasus, or the European. It is only in white men, that the instantaneous penetration of the dermoidal system by the blood can take place; that slight change of the colour of the skin, which adds so powerful an expression to the emotions of the soul. "How can those be trusted, who know not how to blush?" says the European, in his inveterate hatred to the Negro and the Indian. We must also admit, that this insensibility of

the features is not peculiar to every race of men of a very dark complexion: it is much less apparent in the African, than in the natives of America.

To this physical sketch of the Chaymas we shall add a few summary remarks on their manner of living, and on their morals. Unacquainted with the language of the people, I do not pretend to have penetrated their character during my short abode in the Missions. Whenever I speak of the Indians, I shall add what we heard from the missionaries to the little we observed ourselves.

The Chaymas, like all savage people, who dwell in regions excessively hot, have an insuperable aversion to clothing. The writers of the middle age inform us, that in the north of Europe the shirts and drawers, distributed by the missionaries, greatly contributed to the conversion of the Pagan. Under the torrid zone, on the contrary, the natives are ashamed as they say to be clothed; and flee to the woods, when they are too soon compelled to give up their nakedness. Among the Chaymas, in spite of the remonstrances of the monks, men and women remain naked within their houses. When they traverse the village, they wear a kind of tunic of cotton, which scarcely reaches to the knees. It is furnished with sleeves for the men: but the women, and the young boys

to the age of ten or twelve, have the arms, shoulders, and upper part of the breast naked. The tunic is so cut, that the fore part is joined to the back by two narrow bands, which cross the shoulders. When we met the natives, without the Mission, we saw them, especially in rainy weather, stripped of their clothes, and holding their shirts rolled up under their arms. They preferred receiving the rain on their body quite naked, to wetting their clothes. The oldest women hid themselves behind trees, and laughed aloud when they saw us pass. The missionaries complain in general, that the sentiments of decency are scarcely more felt by young girls than by the men. Ferdinand Columbus* relates, that in 1498 his father found the women entirely naked in the island of Trinidad; while the men wore the *guayuco*, which is rather a narrow bandage than an apron. At the same period, on the coast of Paria, the girls

* Life of the Admiral, cap. 71 (*Churchill's Collection*, 1723, vol. ii, p. 586). This Life, written after the year 1537, from original notes in the handwriting of Christopher Columbus, is the most valuable record of the history of his discoveries. It exists only in the Italian and Spanish translations of Alphonso de Ulloa and Gonzales Barcia; for the original, carried to Venice in 1571 by the learned Fornari, has neither been published nor found since. *Napione della Patria di Colombo*, 1804, p. 109 and 295. *Cancellieri sopra Christ. Colombo*, 1809, p. 129.

distinguished themselves from the married women, either, as Cardinal Bembo asserts*, by being quite naked, or, acccording to Gomara†, by the colour of the *guayuco*. This bandage, which is still in use among the Chaymas, and all the naked nations of the Oroonoko, is only two or three inches broad, and is tied on both sides to a string, that encircles the middle of the body. The girls are often married at the age of twelve years; until nine the missionaries allow them to go to church naked, that is to say without a tunic. I need not repeat here, that among the Chaymas, as well as in all the Spanish Missions and the Indian villages, which I have visited, a pair of drawers, or shoes, or a hat, are objects of luxury unknown to the natives. A servant, who had been with us during our journey to Caripe and the Oroonoko, and whom I brought to France, was so much struck on landing, when he saw the ground tilled by a peasant with a hat on, that he thought himself in a miserable country, where even the nobles *(los mismos caballeros)* followed the plough. The Chayma women are not handsome, ac-

* See the eloquent description of America, in the History of Venice (Book 12). "Feminæ virum passæ nullam partem, præter muliebria; virgines ne illam quidem tegebant."

† Las donzellas se conocen en el color y tamano del cordel, y traerlo asi, es senal certissima de virginidad. (Gomara, cap. 73, p. 96).

cording to the ideas that we annex to beauty; yet the girls have something soft and melancholy in their looks, which forms an agreeable contrast with the expression of the mouth, which is somewhat austere and savage. They wear the hair plaited in two long tresses; they do not paint their skin, and from their extreme poverty are acquainted with no other ornaments than necklaces and bracelets made of shells, birds' bones, and seeds. Both men and women are very muscular, but fleshy and plump. It is superfluous to add, that I saw no person, who had any natural deformity; I might say the same of thousands of Caribs, Muyscas, and Mexican and Peruvian Indians, whom we observed during the course of five years. Bodily deformities, deviations from nature, are infinitely rare among certain races of men, especially those nations, who have the dermoid system highly coloured. I cannot believe, that they depend solely on the progress of civilization, a luxurious life, or the corruption of morals. In Europe a deformed or very ugly girl marries if she have a fortune, and the children often inherit the deformity of the mother. In the savage state, which is a state of equality, nothing can induce a man to unite himself to a deformed woman or one who is very unhealthy. If therefore such a women have had the misfor-

tune of attaining an adult age, and have resisted the chances of a restless and disturbed life, she dies without children. We might be tempted to think, that savages all appear well made and vigorous, because feeble children die young for want of care; and that the strongest alone survive; but these causes cannot act on the Indians of the Missions, who have the manners of our peasants, and the Mexicans of Cholula and Tlascala, who enjoy wealth, that has been transmitted to them by ancestors more civilized than themselves. If in every state of cultivation, the copper coloured race manifests the same inflexibility, the same resistance to deviation from a primitive type, are we not forced to admit, that this property belongs in great measure to hereditary organization, to that which constitutes the race? I use intentionally the expression *in great measure*, not entirely to exclude the influence of civilization. Besides, with copper coloured men, as with the whites, luxury and effeminacy, by weakening the physical constitution, had heretofore rendered deformities more common at Couzco and Tenochtitlan. It is not among the Mexicans of the present day, who are all labourers, and leading the most simple lives, that Montezuma would have found the dwarfs and hump-backs, that Bernal Diaz saw waiting at his table when

he dined*. The custom of marrying very young, according to the testimony of the monks, is no way detrimental to population. This precocious nubility depends on the race, and not on the influence of a climate excessively warm. It is found on the north-west coast of America, among the Eskimoes, and in Asia, among the Kamtschadales, and the Coriacs, where girls of ten years old are often mothers. It may appear astonishing, that the time of gestation, the duration of pregnancy, is never altered in a state of health, with any race, or in any climate.

The Chaymas are almost without beard on the chin, like the Tungooses, and other nations of the Mongul race. They pluck out the few hairs that appear; but it is not just to say in general, that they have no beard merely because they pluck out the hairs. Independently of this custom, the greater part of the natives would be nearly beardless†. I say the greater part,

* Bernal Diaz, Hist. verd. de la Nueva Espana, 1630, cap. 91, p. 68.

† There would never have been any difference of opinion between physiologists upon the existence of the beard among the Americans, if they had paid attention to what the first historians of the Conquest of their country have said on this subject; for example, Pigafetta, in 1519, in his journal preserved in the Ambrosian Library at Milan, and published (in 1800) by Amoretti, p. 18; Benzoni, Hist. del Mundo Nuovo, 1572, p. 35; Bembo, Hist. Venet., 1557, p. 86.

for there exist tribes, which, appearing distinct among the others, are so much more worthy of fixing our attention. Such are in North America the Chippeways*, visited by Mackenzie, and the Yabipaees†, near the Toltec ruins at Moqui, with bushy beards; in South America, the Patagonians, and the Guaranies. Among these last individuals are found, some of whom have hairs on the breast. When the Chaymas, instead of extracting the little hair they have on the chin, attempt to shave themselves frequently, their beard grows. I have seen this experiment tried with success by young Indians, who served at mass, and who anxiously wished to resemble the Capuchin Fathers, their missionaries and masters. The greater part of the people, however, have as great an antipathy to the beard, as the Eastern nations hold it in reverence. This antipathy is derived from the same source as the predilection for flat foreheads, which is seen in so singular a manner in the statues of the Azteck heroes and divinities. Nations attach the idea of beauty to every thing, which particularly characterizes their own physical conformation, their natural physiognomy‡. Thence it results, that, if Na-

* Between latitude 60° and 65° north.

† Humb., Nouv. Esp., T. ii, p. 410.

‡ Thus, in their finest statues, the Greeks exaggerated the

ture have bestowed very little beard, a narrow forehead, or a brownish-red skin, every individual thinks himself beautiful, in proportion as his body is destitute of hairs, his head flattened, his skin more covered with *annotto,* or *chica,* or some other coppery red colour.

The Chaymas lead a life of the greatest uniformity. They go to rest very regularly at seven in the evening; and rise long before daylight, at half after four in the morning. Every Indian has a fire near his hammock. The women are so chilly, that I have seen them shiver at church when the centigrade thermometer was not below 18°. The inside of the huts of the Indians is extremely clean. Their hammocks, their mat of reeds, their pots to hold cassava and fermented maize, their bows and arrows, every thing is arranged in the greatest order. Men and women bathe every day, and being almost constantly naked, they are exempted from that want of cleanliness, of which the garments are the principal cause among the lower people in cold countries. Beside a house in the village, they have generally in their *conucos,* near some spring, or at the entrance of some solitary valley, a small hut, covered with the leaves of the

form of the forehead, by elevating beyond proportion the facial line. (Cuv., Anat. Comp. T. ii, p. 6. Humb., Monum. Americ., T. i, p. 158).

palm or plaintain-tree. Though they live less commodiously in the *conuco,* they love to retire thither as often as they can. We have already spoken of that irresistible desire of fleeing from society, and of entering again on a savage life. The youngest children sometimes leave their parents, and wander four or five days in the forests, living on fruits, palm-cabbage, and roots. When travelling in the Missions, it is not uncommon, to find the villages almost deserted, because the inhabitants are in their gardens, or in the forests, *al monte.* Among civilized nations, the passion for hunting is owing perhaps in part to the same sentiments, to the charm of solitude, to the innate desire of independence, to the deep impression made by Nature, whenever man finds himself in contact with her alone.

The condition of the women among the Chaymas, like that in all semibarbarous nations, is a state of privation and suffering. The hardest labour is their share. When we saw the Chaymas return in the evening from their gardens, the man carried nothing but the knife *(machette)*, with which he clears his way among the underwood. The woman however bent under a great load of plantains; she held a child in her arms; and sometimes two other children were placed upon the load. Notwithstanding this inequality of condition, the wives of the

Indians of South-America appear to be in general happier than those of the savages of the North. Between the Alleghany mountains and the Missisippi, wherever the natives do not live in great part on the produce of the chace, the women cultivate the maize, beans, and gourds; and the men take no share in the labours of the field. Under the torrid zone, the hunting nations are extremely scarce, and, in the Missions, the men work in the fields like the women.

Nothing can exceed the difficulty, with which the Indians learn Spanish. They have an absolute aversion to it, while, living separate from the whites, they have not the ambition to be called polished Indians, or, as it is termed in the Missions, *latinized Indians, Indios muy latinos.* But what struck me most, not only among the Chaymas, but in all the very distant Missions, which I afterwards visited, is the extreme difficulty, which the Indians have to arrange and express the most simple ideas in Spanish, even when they perfectly understand the meaning of the words, and the turn of the phrases. When a white questions them concerning objects which surround them from their cradle, they seem to discover an imbecility, which exceeds that of infancy. The missionaries assert, that this embarrassment is not the effect of timidity; that in the Indians who daily visit

the missionary's house, and who regulate the public works, it does not arise from natural stupidity, but from the obstacles they find in the structure of a language so different from their native tongues. The more remote man is from cultivation, the greater his stiffness and moral inflexibility. We must not then be surprised, to find obstacles among the isolated Indians in the Missions, which are unknown to those, who inhabit the same parish with the mestizoes, the mulattoes, and the whites, in the neighbourhood of towns. I have often been surprised at the volubility, with which, at Caripe, the *alcalde*, the *governador*, and the *sargento mayor*, harangue for whole hours the Indians assembled before the church; regulating the labours of the week, reprimanding the idle, threatening the disobedient. Those chiefs, who are equally of the Chayma race, and who transmit the orders of the missionary, speak all at the same time, with a loud voice, with marked emphasis, but almost without action. Their features remain motionless; but their look is imperious and severe.

These same men, who displayed quickness of intellect, and who were tolerably well acquainted with the Spanish, could no longer connect their ideas, when, accompanying us in our excursions around the convent, we put questions to them through the intervention of

the monks. They were made to affirm or deny, whatever the monks pleased: and indolence, attended with that wily politeness, to which the least cultivated Indian is no stranger, induced them sometimes to give to their answers the turn, that seemed to be suggested by our questions. Travellers cannot be enough on their guard against this officious assent, when they wish to support their opinions by the testimony of the natives. To put an Indian Alcade to the proof, I asked him one day, if he did not think the little river of Caripe, which issues from the cavern of the Guacharo, returned into it on the opposite side by some unknown entrance, after having ascended the slope of the mountain. After appearing gravely to reflect on the subject, he answered, by way of supporting my hypothesis: "How else, if it were not so, would there always be water in the bed of the river at the mouth of the cavern?"

The Chaymas have great difficulty in comprehending any thing, that belongs to numerical relations. I never saw a single man, who might not have been made to say, that he was eighteen or sixty years of age. Mr. Marsden has made the same observation on the Malays of Sumatra, though they have been civilized more than five centuries. The Chayma language contains words, which express pretty large num-

bers, but few Indians know how to employ them; and having felt from their intercourse with the missionaries the necessity of so doing, the more intelligent count in Spanish, with an air that denotes a great effort of mind, as far as thirty, or perhaps fifty. The same persons do not count in the Chayma language beyond five or six. It is natural, that they should employ in preference the words of a language, in which they have been taught the series of units and tens. Since the learned of Europe have not disdained to study the structure of the idioms of America, with the same care as they study those of the semitic languages, of the Greek, and of the Latin, they no longer attribute to the imperfection of a language what belongs to the rudeness of the nation. It is acknowledged, that almost every where the idioms display greater richness, and more delicate gradations, than might be supposed from the uncultivated state of the people, by whom they are spoken. I am far from placing the languages of the New World in the same rank with the finest languages of Asia and Europe; but no one of them has a neater, more regular, and simpler system of numeration, than the Qquichua and the Azteck, which were spoken in the great empires of Couzco and Anahuac. Now is it right to assert, that in those languages men do not count beyond four, because in vil-

lages where they are preserved among the poor labourers of Peruvian and Mexican race, individuals are found, who cannot count beyond that number? The singular opinion, that so many American nations reckon only as far as five, ten, or twenty, has been propagated by travellers, who were ignorant, that, according to the genius of the different idioms, men stop, under every climate, at groups of five, ten, or twenty units, (that is, at the fingers of one hand, or of both hands, or at the fingers and toes taken together); and that six, thirteen, or twenty are differently expressed, by five one, ten three, and foot ten*. Can it be asserted, that the numbers of the Europeans do not extend beyond ten, because we stop after having formed a group of ten units?

The construction of the languages of America is so opposite to that of the languages derived from the Latin, that the Jesuits, who had thoroughly examined every thing that could contribute to extend their establishments, introduced among their neophytes, instead of the Spanish, some Indian tongues, very rich, regular, and

* See my American Monuments, vol, ii, p. 229—237. The savages, to express great numbers with more facility, are in the habit of forming groups of five, ten, or twenty grains of maize, according as they reckon in their language by fives, tens, or twenties.

extensive, such as the Qquichua and the Guarani. They endeavoured to substitute these languages in the stead of poorer idioms, more barbarous, and more irregular in their syntax. This substitution was very easy: the Indians of the different tribes adopted it with docility, and thenceforward those American languages generalized became a ready mode of communication between the missionaries and the neophytes. It would be wrong to suppose, that the preference given to the language of the Incas over the Spanish had no other aim, than that of isolating the Missions, and withdrawing them from the influence of two rival powers, the bishops and civil governors. The Jesuits had yet other motives, independent of their policy, for wishing to generalize certain Indian tongues. They found in these languages a common tie, easy to establish between the numerous hordes that had remained separate, hostile to each other, and kept asunder by the diversity of idioms; for in uncultivated countries, after the lapse of several ages, dialects often assume the form, or at least the appearance, of mother tongues.

When it is said that a Dane learns the German, and a Spaniard the Italian or the Latin, more easily than any other language; it is at first thought, that this facility results from the identity of a great number of roots, which

are common to all the Germannic tongues, or to those of Latin Europe: it is not considered, that, with this resemblance of sounds, there is another, which acts more powerfully on nations of a common origin. Language is now the result of an arbitrary convention. The mechanism of inflections, the grammatical constructions, the possibility of inversions, every thing is derived from our interior, our individual organization. There is in man an instinctive and regulating principle, differently modified among nations not of the same race. A climate more or less severe, a residence in the defiles of mountains, or on the borders of the sea, or different habits of life, may alter the pronunciation, render the identity of the roots obscure, and multiply the number: but all these causes do not affect what constitutes the structure and mechanism of languages. The influence of climate, and of external circumstances, vanishes before that which depends on the race, on the hereditary and individual dispositions of men.

Now, in America, (and this result of the more modern researches* is extremely important with respect to the history of our species,) from the country of the Eskimoes to the banks of the

* Vater, in *Mithridates*, T. iii, Part 2, p. 385—409, Id., *Bevælkerung von America*, p. 207.

Oroonoko, and again from these torrid banks to the frozen climate of the Straits of Magellan, mother tongues, entirely different with regard to their roots, have, if we may use the expression, the same physiognomy. Striking analogies of grammatical construction are acknowledged, not only in the more perfect languages, as that of the Incas, the Aymara, the Guarani, the Mexican, and the Cora, but also in languages extremely rude. Idioms, the roots of which do not resemble each other more than the roots of the Sclavonian and the Biscayan, have those resemblances of internal mechanism, which are found in the Sanscrit, the Persian, the Greek, and the German languages. Almost every where in the New World we recognize a multiplicity of forms and tenses* in the

* In the Greenland language, for example, the multiplicity of the pronouns governed by the verb produces twenty-seven forms for every tense of the indicative mood. It is surprising to find, among nations now ranking in the lowest degree of civilization, that want of graduating the relations of time, that superabundance of modifications introduced into the verb, to characterize the object. *Matarpa*, he takes it away: *mattarpet*, thou takest it away: *mattarpatit*, he takes it away from thee: *mattarpagit*, I take away from thee. And in the preterit of the same verb, *mattara*, he has taken it away: *mattaratit*, he has taken it away from thee. This example from the Greenland language shows how the governed and the personal pronouns form one compound, in the American languages, with the radical of the verb. These

verb, an artificial industry to indicate before hand, either by inflexion of the personal pronouns, which form the terminations of the verb, or by an intercalated *suffix*, the nature and the relation of it's object and it's subject, and to distinguish whether the object be animate or inanimate, of the masculine or the feminine gender, simple or in complex number. It is on account of this general analogy of structure, it is because American languages, which have no word in common (the Mexican, for instance, and the Qquichua), resemble each other by their organization, and form complete contrasts with the languages of Latin Europe, that the Indians of the Missions familiarize themselves more easily with an American idiom, than with that of the metropolis. In the forests of the Oroonoko I have seen the rudest Indians speak two or three tongues. Savages of different nations often communicate their ideas to each other by an idiom, which is not their own,

slight differences in the form of the verb, according to the nature of the pronouns governed by it, is found in the old world only in the Biscayan and Congo languages (Vater, *Mithrid.*, vol. iii, P. I, p. 218; P. II, p. 386; and P. III, p. 442. Guillaume de Humboldt, *De La Langue Basque*, p. 58). Strange conformity in the structure of languages on spots so distant, and among three races of men so different, the white Cantabrians, the black Congoes, and the copper-coloured Americans.

If the system of the Jesuits had been followed, languages, which already occupy a vast extent of country, would have become almost general. In Terra Firma, and on the Oroonoko, the Caribbean and the Tamanack alone would now be spoken: and in the south and south west the Qquichua, the Guarani, the Omagua, and the Araucan. In appropriating to themselves these languages, the grammatical forms of which are very regular, and almost as fixed as those of the Greek and Sanscrit, the missionaries would place themselves in more intimate connexion with the natives whom they govern. The numberless difficulties, which occur in the system of the Mission formed by half a score of nations, would disappear with the confusion of idioms. Those which are little diffused would become dead languages; but the Indian, in preserving an American idiom, would retain his individuality, his national physiognomy. Thus by peaceable means would be effected, what those Incas, too highly vaunted, who gave the first example of religious fanaticism in the New World, began to establish by force of arms.

How indeed can we be surprised at the little progress made by the Chaymas, the Caribbees, the Salives, or the Otomacs, in the knowledge of the Spanish language, when we recollect, that one white man, one single missionary, finds himself

alone amidst five or six hundred Indians? and that it is difficult for him to form among them a *governador*, an alcade, or a fiscal, who may serve him as an interpreter? If in place of the system of the missionaries some other means of civilization were substituted, we might rather say some softening of manners (for the reduced Indian has less barbarous manners without having acquired greater knowledge); if, instead of keeping the whites at a distance, they could be mingled with the natives recently united in villages, the American idioms would soon be replaced by the languages of Europe, and the natives would receive in those languages the great mass of new ideas, which are the fruit of civilization. Then the introduction of general tongues, such as that of the Incas, or the Guarani, without doubt would become useless. But after having lived so long in the Missions of South America, after having viewed so closely the advantages and the abuses of the system of the missionaries, I may be permitted to doubt, whether it would be easy to abandon this system; which is very capable of being rendered more perfect, and affords preparatory means for another more conformable to our ideas of civil liberty. It may be objected to me, that the Romans* succeeded in rapidly in-

* I believe we must look into the character of the natives and the state of their civilization, and not into the structure

troducing their language with their sovereignty into the country of the Gauls, into Bœtica, and into the province of Africa; but the natives of these countries were not savages. They inhabited towns; they were acquainted with the use of money; they were in possession of institutions, which indicate a sufficiently advanced state of cultivation. The allurement of commerce, and a long abode of the Roman legions, had promoted an intercourse between them and their conquerors. We see, on the contrary, that the introduction of the languages of the metropolis found obstacles almost innumerable wherever Carthaginian, Greek, or Roman colonies were established on coasts entirely barbarous. In every age, and in every climate, the first impulse of the savage is to shun the civilized man.

The language of the Chayma Indians ap-

of their language, for the reason of this rapid introduction of Latin among the Gauls. The Celtic nations, with brown hair, were certainly different from the race of the Germannic nations, with light hair; and though the Druid cast recalls to our minds one of the institutions of the Ganges, this does not demonstrate, that the idiom of the Celts belongs, like that of the nations of Odin, to a branch of the Indo-pelasgic languages. From analogy of structure and of roots, the Latin ought to have penetrated more easily on the other side of the Danube, than into Gaul; but an uncultivated state, joined to great moral inflexibility, opposed probably it's introduction among the Germannic nations.

peared less agreeable to my ear, than the Caribbee, the Salive, and other languages of the Oroonoko. It has in particular fewer sonorous terminations in accented vowels. We are struck with the frequent repetition of the syllables *guàz*, *ez*, *puec*, and *pur*. We shall soon see, that these terminations are derived in part from the inflexion of the verb *to be;* and from certain prepositions, which are added at the end of words, and which, according to the genius of the American idioms, are incorporated with them. It would be wrong to attribute this rudeness of sounds to the abode of the Chaymas in the mountains. They are strangers to that temperate climate. They have been led thither by the missionaries; and it is well known, that, like all the inhabitants of the warm regions, they dreaded what they called the cold of Caripe. I employed myself, during our abode at the hospital of the Capuchins, in forming a small catalogue of Chayma words. I am aware, that languages are much more strongly characterized by their structure and grammatical forms, than by the analogy of their sounds and of their roots; and that this analogy of sounds is sometimes so disfigured in the different dialects of the same tongue, as not to be distinguishable; for the tribes, into which a nation is divided, often designate the same objects by words altogether heterogeneous. Hence it fol-

lows, that we are easily mistaken, if, neglecting the study of the inflexions, and consulting only the roots, for instance, the words which designate the moon, sky, water, and earth, we decide on the absolute difference of two idioms from the simple want of resemblance in sounds. But, while aware of this source of error, travellers ought to continue, I think, to collect those materials, which their situation may afford them. If they do not make known the interior structure, and the general arrangement of the edifice, they will point out some important parts. Catalogues of words are not to be neglected; they teach us even something with regard to the essential character of an idiom, if the traveller have collected phrases, which show the inflexions of the verb, and the mode of designating the personal and possessive pronouns, so different in different languages.

The three languages most used in the provinces of Cumana and Barcelona are at present the Chayma, the Cumanagote, and the Caribbee. They have been constantly regarded in these countries as different idioms; each of which has it's dictionary, composed, for the use of the Missions, by Fathers Tauste, Ruizblanco, and Breton. The *Vocabulario y Arte de la Lengua de los Indios Chaymas* is become extremely scarce. The few copies of the American grammars, printed for the most part in

the seventeenth century, have passed into the Missions, and have perished in the forests. The dampness of the air, and the voracity of insects *, render the preservation of books almost impossible in those burning regions. They are destroyed in a short space of time, notwithstanding the precautions that are employed. I had much difficulty to collect in the Missions, and in the convents, the grammars † of the American languages, which I remitted, at my return to Europe, into the hands of Mr. Severin Vater, professor and librarian at the university of Kœnigsberg. They furnished him with useful materials for the great work, which he has composed on the idioms of the New World. I had omitted, at the time, to transcribe from my journal, and communicate to that learned gentleman, what I had collected in the Chayma tongue. Since neither Father Gili, nor the Abbè Hervas, have mentioned this language, I shall here explain succinctly the result of my researches ‡.

On the right bank of the Oroonoko, to the south-east of the Mission of Encaramada §, at more than a hundred leagues distance from

* The termites, so well known in Spanish America under the name of *comegen*.

† See note A, at the end of this volume.

‡ See for more ample details, note B.

§ In the latitude of 7°, and 7° 25′.

the Chaymas, live the Tamanacks, *(Tamanacu)* whose language is divided into several dialects. This nation, formerly very powerful, is now reduced to a small number; is separated from the mountains of Caripe by the Oroonoko, and the vast *steppes* of Caraccas and of Cumana; and, what is a barrier far more difficult to surmount, by the nations of Caribbean origin. In spite of this distance and these numerous obstacles, we perceived on examining the language of the Chayma Indians, that it is a branch of the Tamanack tongue. The most ancient missionaries of Caripe have no knowledge of this curious circumstance, because the Capuchins of Arragon seldom visit the southern banks of the Oroonoko, and are almost ignorant of the existence of the Tamanacks. I recognised the analogy between the idiom of this nation, and that of the Chayma Indians long after my return to Europe, in comparing the materials which I had collected with the sketch of a grammar published in Italy by an ancient missionary of the Oroonoko. Without knowing the Chaymas, the Abbé Gili had conjectured, that the language of the inhabitants of Paria* must have some relation to the Tamanack.

* Gili, Saggio di Storia Amer., T. iii, p. 201. Vater has also advanced some well founded conjectures on the connexion that the Tamanack and Caribbean tongues have with

I shall prove this connection by both the methods, that serve to make known the analogy of idioms; I mean, by the grammatical construction, and the identity of words and roots. The following are the personal pronouns of the Chaymas, which are at the same time possessive pronouns; *u-re*, I, me; *eu-re*, thou, thee; *teu-re*, he, him. The Tamanack, *u-re*, I; *amare* or *anja*, thou; *iteu-ja*, he. The radical of the first and of the third person* is

those that are spoken on the north-east coast of South America. *Mithridates*, T. iii, Part II, p. 654 and 676.' I should warn the reader, that I have constantly written the words of the American languages according to the Spanish orthography, so that the *u* should be pronounced *oo*, the *che* like *sche* in German, &c. Having during a great number of years spoken no other language than the Castilian, I marked down the sounds according to the same system of writing, and now I am afraid of changing the value of these signs, by substituting others no less imperfect. It is a barbarous practice, to express, like the greater part of the nations of Europe, the most simple and distinct sounds by many vowels, or many united consonants (*ou, oo, augh, aw, ch, sch, tsch, gh, ph, ts, dz*), while they might be indicated by letters equally simple. What a chaos is exhibited by the vocabularies written according to English, German, French, or Spanish notations! A new essay, which the illustrious author of the travels in Egypt, Mr. de Volney, is going to publish on the analysis of sounds found in different nations, and on the notation of those sounds according to a uniform system, will lead to great progress in the study of languages.

* We must not wonder at those roots, which reduce

in the Chayma *u* and *teu*. The same roots are found in the Tamanack.

CHAYMA.	TAMANACK.
Ure, I.	*Ure.*
Tuna, water.	*Tuna.*
Conopo, rain*.	*Canepo.*
Poturu, to know.	*Puturo.*
Apoto, fire.	*Uapto* (in Caribbean *uato*).
Nuna, the moon, a month.	*Nuna* †.
Je, a tree.	*Jeje.*

themselves to a single vowel. In a language of the Ancient Continent, the structure of which is so artificially complicated, in the Biscayan, the patronymic name *Ugarte* (between the waters) contains the *u* of *ura* (water) and *arte* between. The *g* is added for the sake of euphony. Guillaume de Humboldt on the Biscayan language, p. 46.

* The same word, *conopo*, signifies *rain* and *year*. The years are counted by the number of winters, rainy seasons. They say in Chayma, as in Sanscrit, "*so many rains*," meaning so many years. In the Biscayan, the word *urtea*, year, is derived from *urten*, (frondescere) to bring forth leaves in spring.

† In the Tamanack and Caribbean languages *Nono* signifies the Earth, *Nuna* the Moon; as in the Chayma. This affinity appears to me very curious; and the Indians of the Rio Caura say, that the Moon is *another Earth*. Among savage nations, amidst so many confused ideas, we find certain reminiscences well worthy of attention. Among the Greenlanders *Nuna* signifies the Earth, and *Anoningat* the Moon.

CHAYMA.	TAMANACK.
Ata, a house.	*Aute.*
Euya, to you.	*Auya.*
Toya, to you.	*Iteuya.*
Guäne, honey.	*Uane.*
Nacaramayre, he has said it.	*Nacaramai.*
Piache, (*Piatsche*) a physician, a sorcerer.	*Psiache* (*Psiaschi*).
Tibin, one.	*Obin* (in Jaoi, *Tewin*).
Aco, two.	*Oco* (in Caribbean, *Occo*)
Oroa, two.	*Orua* (in Caribbean, *Oroa*).
Pun, flesh.	*Punu.*
Pra, no (negation).	*Pra.*

The verb substantive *to be*, is expressed in Chayma by *az*. On adding to the verb the personal pronoun *I*, (*u* from *u-re*) a *g* is placed, for the sake of euphony, before the *u*, as in *guaz, I am*, properly *g-u-az*. As the first person is known by an *u*, the second is designated by an *m*, the third by an *i*; thou art, *maz*; *muerepuec araquapemaz?* why art thou sad? properly *that for sad thou be*; *punpuec topuchemaz*, thou art fat in body, properly *flesh (pun) for (puec) fat (topuche) thou be (maz)*. The possessive pronouns precede the substantive; *upatay*, in my house, properly *me house in*. All the prepositions and the negation *pra* are incorporated at the end, as in the Tamanack. We say in Chayma, *ipuec, with him*, properly *him with*; *euya, to thee*, or *thee to*; *epuec char-*

pe guaz, I am gay with thee, properly, *thee with gay I be*; *ucarepra, not as I*, properly, *I as not*; *quenpotupra quoguaz, I do not know him*, properly, *him knowing not I am*; *quenepra quoguaz, I have not seen him*, properly, *him seeing not I am*. In Tamanack, we say, *acurivane*, beautiful, and *acurivanepra*, ugly, not beautiful; *outapra, there is no fish*, properly, *fish not*; *uteripipra, I will not go*, properly, *I to go will not*, composed of *iteri**, to go, *ipiri*, to choose, and *pra*, not. Among the Caribbees, whose language also bears some relation to the Tamanack, though infinitely less than the Chayma, the negation is expressed by an *m* placed before the verb: *amoyenlenganti, it is very cold*; and *mamoyenlengati, it is not very cold*. In an analogous manner, the particle *mna* added to the Tamanack verb, not at the end, but by intercalation, gives it a negative sense, as *taro, to say, taromnar not to say*.

The verb substantive *(to be)*, very irregular

* In Chayma: *utechire*, I will go also, properly *I (u)* to go (the radical *ite*, or, because of the preceding vowel, *te*) also *(chere*, or *ere*, or *ire)*. In *utechire* we find the Tamanack verb to go, *iteri*, of which *ite* is also the radical, and *ri* the termination of the infinitive. In order to show that in Chayma *chere* or *ere* indicates the adverb *also*, I shall cite from the fragment of a vocabulary in my possession *u-chere*, I also; *nacaramayre*, he said so also; *guareazere*, I carried also; *charechere*, to carry also. In the Tamanack, as in the Chayma, *chareri* signifies to carry.

in all languages, is *az* or *ats* in Chayma; and *uochiri* in (composition *uac*, *uatscha*) in Tamanack. It serves not only to form the passive, but it is added also incontestably, as by agglutination, to the radical of attributive verbs, in a number of tenses *. These agglutinations remind us of the employment which the Sanscrit makes of the auxiliary verbs *as* and *bhu* (*asti* and *bhavati* †); the Latin, of *es* and *fu*, or *fus* ‡, the Biscayan, of *izan*, *ucan*, and *eguin*. There are certain points, in which the idioms the most dissimilar, concur. What is common to the intellectual organization of man is reflected in the general structure of language; and every idiom, however barbarous it appears, discovers a regulating principle, which has presided at it's formation.

The plural, in Tamanack, is indicated in seven different ways, according to the termination of the substantive, or according as it designates an animate or inanimate object §. In Chayma

* The present in the Tamanack, *jarer-bac-ure*, appears to me nothing else than the verb substantive *bac*, or *uac* (from *uocschiri*, to be) added to the radical to carry, *jare* (in the infinitive *jareri*), the result of which is *carrying to be I*.

† In the branch of the Germannic languages we find *bhu* under the forms *bim*, *bist*; *as*, in the forms *vas*, *vast*, *vesum* (Bopp, p. 138).

‡ Hence *fu-ero*; *amav-issem*; *amav-eram*; *pos-sum* (*pot-sum*).

§ *Tamanacu*, a Tamanack; plur. *Tamanakemi*: *Pongheme*,

the plural is formed, as in Caribbee *, in *on*; *teure*, himself, *teurecon*, themselves; *tanorocon*, those here; *montaonocon*, those below, supposing that the interlocutor is speaking of a place where he was himself present; *miyonocon*, those below, supposing he speaks of a place where he was not present. The Chaymas have also the Castilian adverbs *aqui* and *allà*, shades of difference which we can express only by periphrases, in the idioms of German and Latin origin.

Some Indians, who were acquainted with Spanish, assured us, that *zis* signified not only the Sun, but also the Deity. This appeared to me the more extraordinary, as among all other American nations we find distinct words for God and the Sun. The Carib does not confound *Tamoussicabo*, the Ancient of Heaven, with the Sun, *Veyou*. Even the Peruvian, though a worshipper of the Sun, raises his mind to the idea of a Being, who regulates the movements of the stars. The Sun, in the language of the Incas, bears the name of *Inti* †, nearly the same

a Spaniard, properly a man clothed; *Pongamo*, Spaniards, or men clothed. The plural in *cne* characterizes inanimate objects: for example, *cene*, a thing; *cenecnc*, things: *jeje*, a tree; *jejecne*, trees.

* Mithridates, T. iii, P. II, p. 687.

† In the *Qquichua*, or language of the Incas, the Sun is *inti*; love, *munay*; great, *veypul*; in Sanscrit, the Sun, *indre*;

as in Sanscrit; while God is called *Vinay Huayna*, the eternally young†.

The arrangement of words in the Chayma is such as is found in every language of both continents, which has preserved a certain air of youth. The object is placed before the verb, the verb before the personal pronoun. The object, on which the attention should be principally fixed, precedes all the modifications of that object. The American would say; *liberty complete love we*; instead of, we love complete liberty; *Thee with happy am I*; instead of, I am happy with thee. There is something direct, firm, demonstrative, in these turns, the simplicity of which is augmented by the absence of the article. Ought we to admit, that with an advanced civilization these nations, left to themselves, would have changed by degrees the arrangement of their phrases? we are led to adopt this idea, when we recollect the changes, which the syntax of the Romans has undergone in the precise, clear, but somewhat timid languages of Latin Europe.

The Chayma, like the Tamanack, and the

love *manya*; great, *vipulo*; (Vater, *Mithridates*, T. iii, p. 333). These are the only examples of analogy of sound, that have yet been noticed. The grammatical character of the two nations is totally different.

† *Vinay*, always, or eternal; *huayna*, in the flower of age.

greater part of the American languages, is entirely destitute of certain letters, as *f*, *b*, and *d*. No word begins with an *l*. The same observation has been made on the Mexican tongue, though it is overcharged with the syllables *tli*, *tla*, and *itl*, at the end or in the middle of words. The Chaymas substitute *r* for *l*, a substitution that arises from a defect of pronunciation common in every zone *. It is thus that the *Caribbees* of the Oroonoko have been transformed into *Galibi* in French Guiana by confounding *r* with *l*, and softening the *c*. The Tamanack has made *chorαro (solalo)* of the Spanish word *soldado*. The disappearance of the *f* and *b* in so many American idioms arises from the intimate connection between certain sounds, which is manifested in all languages of the same origin. The letters *f*, *v*, *b*, and *p*, are substituted one for the other; for instance in the Persian, *peder*, father, pater; *burader* †, frater; *behar*, ver; in Greek, *phorton (fortôn)*, bürde; *pous*, *fouss*. In the same manner with the Americans *f* and *b* become *p*; and *d* becomes *t*. The Chayma pronounces *patre*, *Tios*, *Atani*, *aracapucha*, for *padre*, *Dios*, *Adan*, and *arcabuz* (harquebuss).

In spite of the relations which we have just

* The substitution of *r* for *l* characterizes, for example, the Bashmouric dialect of the Coptic language.

† Whence the German *bruder*, with the same consonants.

pointed out, we do not think, that the Chayma language can be regarded as a dialect of the Tamanack, as the Maitano, Cuchivero, and Crataima, are. There exist many essential differences, and the two languages appear to me at most connected, like the German, the Swedish, and the English. They belong to the same subdivision of the great family of the Tamanack, Caribbean, and Arouack tongues. As there exists no absolute measure of parentage between idioms, the degrees of parentage can be indicated only by examples taken from known tongues. We consider those as being of the same family, which are connected with each other, as the Greek, the German, the Persian, and the Sanscrit.

Some have thought they have discovered, on comparing languages, that they are all divided into two classes *, of which some, more perfect in their organization, more easy and rapid in their movements, indicate an interior developement by *inflexion*; while others, more rude and less susceptible of improvement, present only a crude assemblage of small forms or agglutinated particles, each preserving the physiognomy which is peculiar to itself, when it is separately employed. This very ingenious

* See the learned work of Mr. Frederick Schlegel, *Sprache und Weisheit der Indier*, p. 44—60.

view would be deficient in accuracy, if it were supposed, that there exist polysyllabic idioms without any inflexion, or that those, which are organically developed as by interior germes, admit no external increase by means of *suffixes* and *affixes**; an increase which we have already mentioned several times under the name of agglutination or incorporation. Many things, which appear to us at present inflexions of a radical, have perhaps been in their origin affixes, of which there have barely remained one or two consonants. In languages, as in every thing in nature that is organized, nothing is entirely isolated, or unlike. The farther we penetrate into their internal structure, the more do contrasts and decided characters disappear.

* Even in the Sanscrit several *tenses* are formed by aggregation; for example, in the first *future*, the substantive verb *to be* is added to the radical. In a similar manner we find in the Greek *mach-eso*, if the *s* be not the effect of inflection, and in Latin *pot-ero* (Bopp, p. 26 and 66). These are examples of incorporations and agglutinations in the grammatical system of languages, which are justly cited as models of an interior developement by inflexion. In the grammatical system of the Americans, for example in the Tamanack, *tarecschi*, I will carry, is equally composed of the radical *ar* (infin. *jareri*, to carry) and of the verb substantive *ecschi* (infin. *nocschiri*, to be). There hardly exists in the American languages a triple mode of aggregation, of which we cannot find a similar and analogous example in some other language, that is supposed to develope itself only by inflexion.

"It might de said*, that they are like clouds, the outlines of which do not appear well defined, except when they are viewed at a distance."

But if we do not admit one simple and absolute principle in the classification of languages, we shall not the less agree, that in their present state some display a greater tendency to inflexion, others to external aggregation. It is well known, that the languages of the Indian, Pelasgic, and German branch, belong to the first division; the American idioms, the Coptic or ancient Egyptian, and to a certain degree, the Semitic languages and the Biscayan to the second. The little we have made known of the idiom of the Chaymas of Caripe is sufficient without doubt, to prove that constant tendency toward the incorporation or aggregation of certain forms, which it is easy to separate; though from a somewhat refined sentiment of euphony some letters have been dropped, and others have been added. Those affixes, in lengthening words, indicate the most varied relations of number, time, and motion.

When we reflect on the peculiar structure of the American languages, we imagine we discover the source of the very ancient and universal opinion in the Missions, that these lan-

* Guill. de Humb., *sur la Monographie des Langues*, § I. The same, *sur la Langue Basque*, p. 43, 46, 50.

guages have an analogy with the Hebrew, and the Biscayan. Every where, at the Convent of Caripe as well as at the Oroonoko, in Peru as in Mexico, I heard this idea announced; and particularly by monks who had some vague notions of the Semitic languages. Did motives which were thought to be interesting to religion cause so extraordinary a theory to be established? In the north of America, among the Chactaws and the Chickasaws, travellers somewhat credulous have heard the Hallelujah * of the Hebrews sung; as, according to the pundits, the three sacred words of the mysteries of the Eleusis † *(konx om pax)* resound still in the Indies. I do not suspect, that the nations of Latin Europe have called whatever has a foreign physiognomy Hebrew or Biscayan, as for a long time all those monuments were called Egyptian, which were not in the Grecian or Roman style. I rather think, that the grammatical system of the American idioms has confirmed the missionaries of the sixteenth century in their ideas respecting the Asiatic origin of the nations of the New World. The tedious compilation of Father Garcia, *Tratado del Ori-*

* L'Escarbot, Charlevoix, and even Adair (Hist. of the American Indians, 1775, p. 15—220).

† Asiat. Res., Vol. v, p. 231. Ouvaroff, on the Eleusinian Mysteries, 1816, p. 27 and 115.

*gen de los Indios**, is a proof of this. The position of the possessive and personal pronouns at the end of the noun and the verb, as well as the numerous tenses of the latter, characterize the Hebrew, and the other Semitic languages. The minds of some of the missionaries have been struck at finding the same gradations in the American tongues. They were ignorant, that the analogy of several scattered features does not prove, that languages belong to the same stock.

It appears less astonishing, that men, who are well acquainted with only two languages extremely heterogeneous, the Castilian and the Biscayan, should have found in the latter a family likeness with the American languages. The composition of words, the facility with which the partial elements are detected, the forms of the verb, and the different modifications which it undergoes according to the nature of the object, may have caused and kept up this illusion. But we repeat, an equal tendency toward aggregation or incorporation does not constitute an identity of origin. The following are examples of these relations of physiognomy between the American and Biscayan languages; between idioms which differ entirely in their roots.

* Libro iii, Cap. 7, §. 3.

In Chayma; *quenpotupra quoguaz*, I do not know, properly, knowing not I am. In Tamanack, *jarer-uac-ure*, bearing am I, I bear; *anarepra aichi*, he will not bear, properly, bearing not will be; *patcurbe*, good; *patcutari*, to make himself good; *Tamanacu*, a Tamanack; *Tamanacutari*, to make himself a Tamanack; *Pongheme*, a Spaniard; *ponghemtari*, to spaniardize himself; *tenectschi*, I will see; *teneicre*, I will see again; *tecscha*, I go; *tecshare*, I return; *maypur butke*, a little Maypure Indian; *aicabutke*, a little woman*; *maypuritajé*, an ugly Maypure Indian; *aicataje*, an ugly woman.

In Biscayan: *maitetutendot*, I love him, properly, I loving have him; *beguia*, the eye, and *beguitsa*, to see; *aitagana*, toward the father; by adding *tu*, we form the verb *aitaganatu*, to go toward the father; *ume-tasuna*, soft and infantile ingenuity; *umequeria*, disagreeable childishness †.

I will add to these examples some descriptive compounds, which call to mind the infancy of nations, and strike us equally in the American

* The diminutive of woman (*aica*) or of Maypure Indian is formed, by adding *butke* the termination of *cujuputke*, little: *taje* answers to the *accio* of the Italians.

† The termination *tasuna* indicates a good quality; *queria* a bad one, and is derived from *eria*, illness (Guill. de Humb., Basques, p. 40).

and Biscayan languages, by a certain ingenuousness of expression. In Tamanack, the wasp, *uaneimu*; father *(im-de)*; of honey *(uane)*: the toes, *ptari-mucuru*, properly, the sons of the foot; the fingers, *amgna-mucuru*, the sons of the hand; mushrooms, *jeje-panari*, properly, the ears *(panari)* of a tree *(jeje)*; the veins of the hand, *amgna-mitti*, properly, the ramified roots; leaves, *prutpe-jareri*, properly, the hair of the top of the tree; *puirene-veju*, properly Sun *(veju)* straight or perpendicular; lightning *, *kinemeru-uaptori*, properly, the fire *(uapto)* of the thunder, or of the storm. In Biscayan, *becoquia*, the forehead, what belongs *(co* and *quia)* to the eye *(beguia)*; *odotsa*, the noise *(otsa)* of the cloud *(odeia)*, or thunder; *arribicia*, an echo, properly, the animated stone, from *arria*, stone, and *bicia*, life.

The Chayma and Tamanack verbs have an enormous complication of tenses, two presents, four preterits, three futures. This multiplicity characterizes the rudest American languages. Astarloa reckons, in like manner, in the grammatical system of the Biscayan, two hundred and six forms of the verb. Those languages, the principal tendency of which is inflexion, excite less the curiosity of the vulgar, than those which seem formed by aggregation. In the

* I recognise in *kinemeru*, thunder or storm, the root *kineme*, black.

first, the elements of which words are composed, and which are generally reduced to a few letters, are no longer distinguished. These elements, when isolated, exhibit no meaning; the whole is assimilated and mingled together. The American languages, on the contrary, are like complicated machines, the wheels of which are exposed. The artifice is visible; I mean, the industrious mechanism of their construction. We seem to be present at their formation, and we should state them to be of a very recent origin, if we did not recollect, that the human mind follows imperturbably an impulse once given; that nations enlarge, improve, and repair the grammatical edifice of their language, according to a plan already determined; finally, that there are countries, the languages, the institutions, and the arts of which, have remained invariable, we might almost say stereotyped, during the lapse of ages.

The highest degree of intellectual developement has been hitherto found among nations, which belong to the Indian and Pelasgic branch. The languages formed principally by aggregation seem themselves to oppose obstacles to the improvement of the mind. They are in fact unfurnished with that rapid movement, that interior life, to which the inflexion of the root is favourable, and which gives so many charms to works of the imagination. Let us not, however,

forget, that a people celebrated in the remotes antiquity, from whom the Greeks themselves borrowed knowledge, had perhaps a language, the construction of which recals involuntarily that of the languages of America. What a scaffolding of little monosyllabic and dissyllabic forms is added to the verb, and to the substantive, in the Coptic language! The Chayma and the Tamanack, half barbarous, have tolerably short abstract words to express grandeur, envy, and lightness, *cheictivate*, *uoite*, and *uonde*; but in Coptic, the word malice *, *metrepherpetou*, is composed of five elements, easy to be distinguished. It signifies the quality *(met)* of a subject *(reph)*, which makes *(er)* the thing which is *(pet)*, evil *(ou)*. Nevertheless the Coptic language has had it's literature, like the Chinese, the roots of which, far from being aggregated, scarcely approach each other without immediate contact. We must admit, that nations once awakened from their lethargy, and tending toward civilization, find in the most uncouth languages the secret of expressing with clearness the conceptions of the mind, and of painting the emotions of the soul. A re-

* See on the incontestible identity of the ancient Egyptian and Coptic, and on the particular system of synthesis of the latter language, the ingenious reflexions of Mr. Silvestre de Sacy, in the "*Notice des Recherches de M. Etienne Quatremère sur la Littérature de l'Egypte*, p. 18 and 23.

spectable man, who has perished in the bloody revolutions of Quito, Don Juan de la Rea, had imitated with graceful simplicity some idyls of Theocritus in the language of the Incas; and I have been assured, that, excepting treatises of science and philosophy, there is scarcely any work of modern literature, that might not be translated into Peruvian.

The intimate connections, that have been formed between the natives and the Spaniards since the conquest, have introduced a certain number of American words into the Castilian language. Some of these words express things not unknown before the discovery of the New World, and scarcely recal to our minds at present their barbarous* origin. Almost all belong to the language of the greater West India Islands, which was formerly designated under the name of the language of Haïti, of Quizqueja, or of Itis †. I shall confine myself to citing the words *maïz*, *tabaco*, *canoa*, *batata*, *cacique*, *balsa*, *conucó*, *&c.* When the Spaniards, from the year 1498, began to visit the main land, they had already words ‡

* For example savana, cannibal.

† The word Itis for Haïti or St. Domingo (Hispaniola) is found in the *Itinerarium* of Bishop Geraldini (*Romæ*, 1631, p. 206). "Quum Colonus *Itim* insulam cerneret."

‡ The following are Haytian words, in their real form, that have passed into the Castilian language from the end of

to designate the vegetables that are most useful to man, and that are common both to the

the 15th century, and a great part of which are not uninteresting to descriptive botany. *Ahi* (capsicum baccatum), *batata* (convolvulus batatas), *bihao* (heliconia bihai), *caimito* (chrysophyllum caimito), *cahoba* (swietenia mahagoni), *jucca* and *casabi* (iatropha manihot; the word *casabi* or *cassave* is employed only for the bread made with the roots of the iatropha; the name of the plant, *jucca*, was also heard by Americus Vespucius on the coast of Paria), *age* or *ajes* (dioscorea alata), *copei* (clusia alba), *guayacan* (guaiacum officinale), *guajaba* (psidium pyriferum), *guanavano* (anona muricata), *mani* (arachis hypogæa), *guama* (inga), *henequen* (was supposed by the false accounts of the first travellers to be an herb, with which the Haytians used to cut metals; it means now every kind of strong thread), *hicaco* (chrysobalanus icaco), *maghei* (agave Americana), *mahiz* or *maiz* (zea), *mamei* (mammea Americana), *mangle* (rhizophora), *pitahaja* (cactus pitahaja), *ceiba* (bombax), *tuna* (cactus tuna), *hicotea* (a tortoise), *iguana* (lacerta iguana), *manati* (trichecus manati), *nigua* (pulex penetrans), *hamaca* (a hammock), *balsa* (a raft; however *balsa* is an ancient Castilian word signifying a pool of water), *barbacoa* (a small bed of light wood, or reeds), *canei* or *buhio* (a hut), *canoa* (a boat), *cocujo* (elater noctilucus), *chicha*, *tschischa* (fermented liquor), *macana* (a large stick or club, made with the petioles of a palm-tree), *tabaco* (not the herb, but the pipe through which it is smoked), *cazique* (a chief). Other American words, now as much in use among the Creoles, as the Arabic words naturalized in the Spanish, do not belong to the Haïtian tongue; for example, *caiman*, *piragua*, *papaja* (carica), *aguaçate* (persea), *tarabita*, *paramo*. Abbé Gili thinks with some probability, that they are derived from the tongue of some people, who inhabited the temperate climate between Coro, the mountains of Merida,

islands and to the coasts of Cumana and Paria. They were not satisfied with retaining these words borrowed from the Haitians, but contributed also to spread them all over America, at a period when the language of Haïti was already a dead language, and among nations who were ignorant even of the existence of the West India Islands. Some words, which are daily made use of in the Spanish colonies, are attributed erroneously to the Haitians. *Banana* is from the Chaconese, the *Mbaja* language; *arepa* (bread of manioc, or of the jatropha manihot) and *guayuco* (an apron, *perizoma*) are Caribbee: *curiara* (a very long boat) is Tamanack: *chinchorro* (a hammock), and *tutuma* (the fruit of the crescentia cujete, or a vessel to contain a liquid), are Chayma words.

I have dwelt a long time on considerations respecting the American tongues, because in analyzing them for the first time in this work, I wished that the interest of this kind of research should be deeply felt. This interest is analogous to that inspired by the monuments

and the tableland of Bogota (Saggio, Vol. iii, p. 228. See also above, vol. ii, p. 252, of the present work). How many Celtic and German words would not Julius Cæsar and Tacitus have handed down to us, if the productions of the northern countries visited by the Romans had differed as much from the Italian and Roman, as those of equinoxial America!

of semibarbarous nations, which are examined not because they deserve a place among the works of art, but because their study throws some light on the history of our own species, and the progressive display of our faculties.

After the Chaymas, it remains for me to speak of the other Indian nations, which inhabit the provinces of Cumana and Barcelona. These I shall only succinctly enumerate.

1. The *Pariagotoes* or *Parias*. It is thought, that the terminations in *goto*, as in Pariagoto, Purugoto, Avarigoto, Acherigoto, Cumanagoto, Arinagoto, Kirikirisgoto *, imply a Caribbean origin †. All these tribes, excepting the Purugotoes of Rio Caura, formerly occupied the country, which has been so long under the dominion of the Caribbees; namely, the coasts of Berbice and of Essequibo, the peninsula of Paria, the plains of Piritoo and Parima. It is by this last name that the country little known,

* The *Kirikirisgotoes* (or *Kirikiripas*) are of Dutch Guiana. It is very remarkable, that among the small Brazilian tribes that do not talk the language of the Tupis, the *Kiriris*, notwithstanding the enormous distance of 650 leagues, have several Tamanack words.

† In the Tamanack tongue, which is of the same branch as the Caribbean, we find also the termination *goto*, as in *anekiamgoto*, an animal. Often an analogy in the termination of names, far from showing an identity of race, only indicates, that the names of the nations are borrowed from one language.

between the sources of the Cujuni, the Caroni, and the Mao, is designated in the Missions. The Paria * Indians are mingled in part with the Chaymas of Cumana; others have been settled by the Capuchins of Arragon in the Missions of Caroni; for instance, at Cupapuy and Alta-Gracia, where they still speak their own language, which appears to be a mean between the Tamanack and the Caribbee. But is the name of Parias or Pariagotoes a name merely geographical? Did the Spaniards, who frequented these coasts from their first establishment in the Island of Cubagua and in Macarapana, confer the name of the promontory of Paria † on the tribe by which it was inhabited?

* Caulin, p. 9, 88, 136. Vater, Vol. iii, Part 2, p. 465, 617, 676. Gili, Vol. iii, p. 201, 205.

† Paria, Uraparia, even Huriaparia and Payra, are the ancient names of the country, written as the first navigators thought they heard them pronounced (Ferd. Columbus, in *Churchill's Collection*, Vol. ii, p. 586, chap. 71. Galvano, in *Hakluyt's Suppl.*, 1812, p. 18. *Petrus Martyr*, p. 73—75. *Girolamo Benzoni*, p. 7. *Geraldini Itinerar.*, p. 17. Christ. Columbi Navigatio, in *Gryn. Orb. Nov.* p. 80 and 86. *Gomara*, p. 109, cap. 84.) It appears to me not at all probable, that the promontory of Paria should derive it's name from that of a Cacique *Uriapari*, celebrated for the manner in which he resisted Diego Ordaz in 1530, thirty two years after Columbus had heard the name of *Paria* from the mouths of the natives themselves. (*Fray Pedro Simon*, p. 103, Noticia 2, cap. 16. Caulin, p. 134 and 143.) The Oroonoko at it's mouth had also the name of Uriapari, Yuyapari,

This we will not positively affirm; for the Caribbees themselves give the name of Caribana * to a country which they occupied, and which extended from the Rio Sinu, to the Gulf of Darien. This is a striking example of an identity of name between an American nation and the territory it possessed. We may conceive, that in a state of society, where residence is not long fixed, such instances must be very rare.

2. The *Guaraons* or *Gu-ara-unu*, almost all free and independent, dispersed in the Delta of the Oroonoko, with the variously ramified channels of which they alone are well acquainted. The Caribbees call the Guaraons *U-ara-u*.

or Iyupari (Herrera, Dec., vol. i, p. 80, 84, and 108). In all these denominations of a great river, of a shore, and of a rainy country, I think I recognise the radical *par*, signifying water, not only in the languages of these countries, but also in those of nations very distant from one another on the eastern and western coasts of America. The sea, or great water, is in the Caribbean, Maypure, and Brazilian languages, *parana*: in the Tamanack, *parava*. In Upper Guiana the Oroonoko is also called Parava. In the Peruvian, or Qquichua, I find rain, *para*; to rain, *parani*. Besides, there is a lake in Peru, that has been very anciently called Paria (Garcia, Origen de los Ind., p. 292). I have entered into these minute details concerning the word Paria, because very recently some persons have thought they could recognise in this word the country of the Parias, a Hindoo cast.

* *Petrus Martyr, Ocean.*, p. 125.

They owe their independence to the nature of their country; for the missionaries, in spite of their zeal, have not been tempted to follow them on the tops of the trees. It is well known, that the Guaraons, in order to raise their abodes above the surface of the waters at the period of the great inundations, support them on the cut trunks of the mangrove-tree and of the mauritia palm-tree *. They make bread of the medullary flour of this palm-tree, which is the true sago of America. The flour bears the name of *yuruma:* I have eaten of it at the town of St. Thomas in Guiana, and it seemed very agreeable to the taste, resembling rather the cassava bread than the sago † of India. The Indians assured me, that the trunks of the mauritia, the *tree of life* so much vaunted by father Gumilla, do not yield meal in any abundance, except the palm-tree is cut down just

* Their manners have always been the same. Cardinal Bembo described them at the beginning of the 16th century. "quibusdam in locis propter paludes incolæ domus in arboribus ædificant." (Hist. Venet., 1551, p. 88.) Sir Walter Raleigh, in 1595, speaks of the Guaraons under the names of *Araottes, Trivitivas,* and *Warawites.* These were perhaps the names of some tribes, that divided the great Guaraonese nation. (Barrere, Essai sur l'Hist. Naturelle de la France équin., p. 150.)

† Mr. Kunth has united together three genera of the palms, calamus, sagus, and mauritia, in a new section, the calameæ.

before the flowers appear. Thus too the *maguey* *, cultivated in New Spain, furnishes a saccharine liquor, the wine *(pulque)* of the Mexicans, only at the period when the plant pushes out it's long stem. By interrupting the blossoming, nature is obliged to carry elsewhere the saccharine or amylaceous matter, which would have accumulated in the flowers of the maguey and in the fruit of the mauritia. Some families of Guaraons, associated with the Chaymas, live far from their native land, in the Missions of the plains or Llanos of Cumana: as for instance, at Santa-Rosa de Ocopi. Five or six hundred of them voluntarily quitted their marshes, a few years ago, and formed on the northern and southern banks of the Oroonoko, at twenty-five leagues distance from Cape Barima, two pretty considerable villages, under the names of Zacupana and Imataca. When I made my journey in Caripe, these Indians were still without missionaries, and lived in complete independence. The excellent qualities of these natives as seamen, their great number, their perfect knowledge of the mouths of the Oroonoko, and of the labyrinth of branches communicating with each other, give the Guaraons a certain political importance. They favour that clandestine commerce of which the Island of

* Agave Americana, the aloe of our gardens.

Trinidad is the centre. They would also facilitate probably any military expedition, that should ascend the Oroonoko to attack Spanish Guiana. The governors of Cumana long ago sought to call the attention of the ministry to this Indian tribe, but always without success. The Guaraons run with extreme address on muddy lands, where the Whites, the Negro, or any other Indian, would not dare to walk; and it is therefore commonly believed, that they are of less weight than the rest of the natives. This is also the opinion that is held in Asia of the Burat Tatars. The few Guaraons, whom I saw, were of middle size, squat, and very muscular. The lightness with which they walk in places newly dried, without sinking in, when even they have no planks tied to their feet, seemed to me the effect of long habit. Though I sailed a considerable time on the Oroonoko, I never went so low as it's mouth. Future travellers, who visit those marshes, will rectify what I have advanced.

3. The *Guaiquerias* or *Guaikeries*. They are the most able and most intrepid fishermen of these countries; and they alone are well acquainted with the bank abounding with fish, that surrounds the islands of Coche, Margaretta, Sola, and Testigos; a bank of more than four hundred square leagues, extending east and west from Maniquares to the mouths of the Dragon.

The Guaikeries inhabit the island of Margaretta, the peninsula of Araya, and that suburb of Cumana, which bears their name. We have already observed*, that they believe their language to be a dialect of that of the Guaraounoes. This would connect them with the great family of the Caribbee nations; for the missionary Gili† thinks, that the idiom of the Guaikeries is one of the numerous branches of the Caribbean tongue. These affinities are interesting, because they lead us to perceive an ancient connection between nations dispersed over a vast extent of country, from the mouth of the Rio Caura‡ and the sources of

* Vol. ii, ch. IV, p. 198. (See also *Hervas, Cat.*, p. 49). If the name of the Port *Pam-patar*, in the Island of Margaretta, be Guaiquerie, as we have no reason to doubt; it exhibits a feature of analogy with the Cumanagoto tongue, which approaches the Caribbean and Tamanack. In Terra Firma, in the Piritoo Missions, we find the village of *Cayguapatar*, which signifies *house of Caygua.*

† Vol. ii, chap. IV, p. 198. Vater, Tom. iii, P. II, p. 676.

‡ Are the *Guaikeries*, or *O-aikeries*, now settled on the borders of the Erevato, and formerly between the Rio Caura and the Cuchivero, near the little town of Alta Gracia, of a different origin from the Guaikeries of Cumana? I know also in the interior of the country, in the Missions of the Piritoos, near the village of San Juan Evangelista del Guarive, a ravine very anciently called *Guayquiricuar.* These indications seem to prove migrations from the south-west toward the coast. The termination *cuar*, found so often in

the Erevato, in Parima, to French Guiana and the coasts of Paria.

4. The *Quaquas,* whom the Tamanacks call *Mapoje,* a tribe formerly very warlike and allied to the Caribbees. It is a curious phenomenon to find these mingled with the Chaymas in the Missions of Cumana, for their idiom, as well as the Atura of the cataracts of the Oroonoko, is a dialect of the Salive tongue; and their original abode was on the banks of the Assiveru, which the Spaniards call Cuchivero. They have pushed their migrations one hundred leagues to the north-east. I have often heard them mentioned on the Oroonoko, above the mouth of the Meta; and, what is very remarkable, it is asserted*, that missionary Jesuits have found Quaquas as far distant as the Cordilleras of Popayan. Raleigh enumerates, among the natives of the Island of Trinidad, the Salives, a tribe of the mildest manners, from the Oroonoko, which dwells south of the

Cumanagote and Caribbean names, means a *ravine,* as in *Guaymacuar* (Ravine of Lizards) *Pirichucuar* (a ravine overshaded by pirichoo or piritoo palm-trees), *Chiguatacuar,* (a ravine of land shells). Raleigh describes the Guaikeries under the name of Ouikeries. He calls the Chaymas Saimas, changing (according to the Caribbean pronunciation) the *che* into *s.*

* Vater, Tom. iii, P. II, p. 364. The name of *Quaqua* is found on the coast of Guinea. The Europeans give it to a horde of Negroes to the east of Cape Lahou.

Quaquas. Perhaps these two tribes, which speak almost the same language, travelled together toward the coasts.

5. The *Cumanagotoes*, or, according to the pronunciation of the Indians, *Cumanacoto*, at present to the west of Cumana, in the Missions of Piritoo, where they live by cultivating the ground to the number of more than twenty-six thousand. Their language, like that of the *Palenkas*, or *Palenques*, and Guarivas, is between the Tamanack and the Caribbee, but nearer to the former. These are indeed idioms of the same family; but, if we were to consider them as simple dialects, the Latin must be also called a dialect of the Greek, and the Swedish a dialect of the German. When the question arises of the affinity of languages with each other, it ought not to be forgotten, that these affinities may be very differently graduated; and that it would be to confound every thing, not to distinguish between simple dialects, and languages of the same family. The Cumanagotoes, the Tamanacks, the Chaymas, the Guaraons, and the Caribbees, do not understand each other, in spite of the frequent analogy of words and of grammatical structure exhibited in their idioms. The Cumanagotoes inhabited, at the beginning of the sixteenth century, the mountains of the Brigantine and of Parabolata. Father Ruiz Blanco, at first

professor at Seville, and then missionary in the province of New Barcelona, published, in 1683, a grammar of the Cumanagoto, and some theological works in the same language. I have not been able to learn, whether the Piritoos, Cocheymas, Chacopatas, Tomuzas, and Topocuares, now confounded in the same villages with the Cumanagotoes, and speaking their language, were originally tribes of the same nation. The Piritoos, as we have elsewhere observed, have taken their name from the ravine *Pirichucuar*, where the small thorny palm-tree*, called piritoo, grows in abundance; the wood of which, excessively hard, and therefore little combustible, serves to make pipes. On this spot the village of the Conception of Piritoo was founded in 1556, the chief place of the Cumanagoto Missions, known by the name of the *Missiones de Piritu.*

6. The *Caribbees (Carives).* This is the name which was given them by the first navigators, and which is retained throughout all Spanish America. The French and the Germans have transformed it, I know not why, into Caraïbes. They call themselves *Carina, Calina,* and *Callinago.* I traversed some Caribbean Missions

* Caudice gracili aculeato, foliis pinnatis. Perhaps of the genus aiphanes of Willdenouw. (See my *Proleg. de Distrib. geogr. Plant.,* 1817, p. 228.)

in the *Llanos**, in returning from my journey to the Oroonoko; and I shall confine myself here to repeating, that the *Galibes (Caribi* of Cayenne), the Tuapocas, and the Cunaguaras, who inhabited originally the plains between the mountains of Caripe (Caribe) and the village of Maturin, the *Jaoi* of the Island of Trinidad and of the province of Cumana, and perhaps also the Guarivas, allies of the Palenkas, are tribes of the great and fine Caribbee nation.

With respect to the other nations, whose affinities of language with the Tamanack and the Caribbee we have mentioned, we do not think it indispensable, to consider them as of the same race. In Asia, the nations of Mongul origin differ totally in their physical organization from those of Tatar origin. Such has been, however, the mixture of these nations, that, according to the acute researches of Mr. de Klaproth, the Tatar languages (branches of the ancient Oigour) are spoken at present by hordes incontestably of the Mongul race. Neither the analogy nor the diversity of language can suffice, to solve the great problem of the filiation

* I shall in future use the word *Llanos* (*loca plana*, suppressing the *p*), without adding the equivalent words *pampas, savannas, meadows, steppes, or plains.* The country between the mountains of the coast, and the left bank of the Oroonoko, constitutes the *Llanos* of Cumana, Barcelona, and Caraccas.

of nations; they afford only simple probabilities. The Caribbees, properly speaking, those who inhabit the Missions of the Cari, in the Llanos of Cumana, the banks of the Caura, and the plains to the north-east of the sources of the Oroonoko, are distinguished by their almost gigantic size from all the other nations I have seen in the new continent. Must it on this account be admitted, that the Caribbees are an entirely distinct race? and that the Guaraons and the Tamanacks, whose languages have an affinity with the Caribbee, have no bond of relationship with them? I think not. Among the nations of the same family, one branch may acquire an extraordinary developement of it's organization. The mountaineers of the Tyrol and the Salzburgh are taller than the other Germannic races; the Samoyedes of the Altai are not so little and squat as those of the sea-coast. In the same manner it would be difficult to deny, that the Galibis are real Caribbees; and yet, notwithstanding the identity of languages, what a striking difference in their stature and physical constitution!

While indicating the elements of which the indigenous population of the provinces of Cumana and Barcelona is at present composed, I would not mingle historical memorials with the simple enumeration of facts. Before Cortez burnt his ships at his landing on the coast of

Mexico, before he entered the capital of Montezuma in 1521, the attention of Europe was fixed on the regions, which we have just traversed. In painting the manners of the inhabitants of Paria and Cumana, it was thought that the manners of all the inhabitants of the new continent were described. This remark cannot escape those, who read the historians of the Conquest, especially the letters of Peter Martyr of Anghiera, written at the court of Ferdinand the Catholic, filled with ingenious observations upon Christopher Columbus, Leo X, and Luther, and inspired by a noble enthusiasm for the great discoveries of an age so rich in extraordinary events. Without entering into any detail on the manners of the nations, which have been so long confounded under the vague denomination of Cumanians *(Cumaneses)*, it appears to me important to clear up a fact, which I have often heard discussed in Spanish America.

The Pariagotoes at present are of a brown red, as are the Caribbees, the Chaymas, and almost all the nations of the New World. Why do the historians of the 16th century affirm, that the first navigators saw white men with fair hair, at the promontory of Paria? Were they of the same race as those Indians, with a skin less tawny, whom Mr. Bonpland and myself saw at Esmeralda, near the sources of the

Oroonoko? But these Indians had hair as black as the Otomacks and other tribes, whose complexion is the deepest. Were they Albinoes, such as have been found heretofore in the isthmus of Panama? But examples of this degeneration are very rare in the coppercoloured race; and Anghieri, as well as Gomara, speaks of the inhabitants of Paria in general, and not of a few individuals. Both describe * them as if they were people of Germannic origin; they call them Whites with light hair; they even add, that they wore garments like those of the Turks †. Gomara and Anghiera wrote from

* Æthiopes nigri, crispi lanati, Pariæ incolæ *albi*, capillis oblongis protensis *flavis*. Petrus Martyr, *Ocean.*, Dec. 1, Lib. vi, (ed. 1574), p. 71. Utriusque sexus indigenæ *albi veluti nostrates, præter eos qui sub sole versantur.* Ibid, p. 75. Gomara, speaking of the natives that Columbus saw at the mouth of the river of Cumana, says: "Las donzellas eran amorosas, desnudas y *blancas* (las de la casa); los Indios que van al campo estan negros del sol." *Hist. de los Indios*, cap. 74, p. 97. Los Indios de Paria son *blancos* y rubios. Garcia, *Origen de los Indios*, 1729, Lib. iv, cap. 9, p. 270.

† They wear round their head a striped cotton handkerchief. Ferd. Columb., cap. 71 (Churchill, vol. ii, p. 586). Was this kind of head-dress taken for a turban? (Garcia, del Origen de los Ind., p. 303). I am surprised, that a people of those regions should wear a head-dress; but, what is much more curious still, Pinzon, in a voyage that he made alone to the coast of Paria, the particulars of which have been transmitted to us by Peter Martyr of Anghiera, professes to have seen natives who were clothed.

the oral relations, which they had been able to collect.

These marvels disappear, if we examine the recital, which Ferdinand Columbus * drew from his father's papers. There we find simply, that "the admiral was surprised to see the inhabitants of Paria, and those of the Island of Trinidad, better made, more civilized, *(de buena conversacion,)* and whiter, than the natives which he had till then seen." This certainly did not mean, that the Pariagotoes are white. The less dark colour of the skin of the natives, and the great coolness of the mornings on the coast of Paria, seemed to confirm the fantastic hypothe-

"Incolas omnes genu tenus mares, fœminas surarum tenus, gossampinis vestibus amictos simplicibus repererunt; sed viros more Turcarum insuto minutim gossipio ad belli usum duplicibus." (Pet. Martyr, Dec. ii, Lib. vii, p. 183.) Who were these people more civilized, clothed with tunics as on the summit of the Andes, and observed on a coast, where before and since the time of Pinzon only naked men have ever been seen?

* Churchill's Collection, vol. ii, p. 584 and 586. Herrera, p. 80, 83, 84. Munoz, Hist. del Nuevo Mundo, vol. i, p. 289. "El color era bazo como es regular en los Indios, pero mas claro que en las islas reconocidas." The missionaries are accustomed to call those Indians, that are less black, less tawny, *whitish*, and even *almost white*. (Gumilla, *Hist. de l'Orenoque*, vol i, chap. v, §. 2). These improper expressions may mislead those, who are not accustomed to the exaggerations, in which travellers often indulge themselves.

sis, which this great man had framed, of the irregularity of the curvature of the earth, and of the height of the plains in this region, as the effect of an extraordinary swelling of the globe in the direction of the parallels of latitude *. Amerigo Vespucci (if we may be allowed to cite his pretended *first* Voyage, composed perhaps from the recital of other navigators,) compares the natives to the Tatar nations †, not for their colour, but for the broadness of their face, and the general expression of their physiognomy.

But if it be certain, that at the end of the 15th century there were on the coast of Cumana a few men with a white skin, as there are in our days, it must not thence be concluded, that the natives of the New World display every where a similar organization of the dermoidal system. It is not less inaccurate to say, that they are all coppercoloured, than to affirm, that they would not have a tawny hue, if they were not exposed to the heat of the sun, or tanned by the action of the air. The natives may be divided into two very unequal portions with respect to numbers; to the first belong the Eskimoes of Greenland, of Labrador, and the northern coast of Hudson's Bay, the inha-

* See note C at the end of this chapter.

† Vultu non multum speciosi sunt, quoniam latas facies *Tartariis* adsimilatas habent. (Americi Vesputii *Navigatio prima*, in Gryn's *Orb. Nov.*, 1555, p. 212.)

bitants of Behring's Straits, of the peninsula of Alaska, and of Prince William's Sound. The eastern and western branch * of this polar race, the Eskimoes and the Tschougazes, notwithstanding the enormous distance of eight hundred leagues which separates them, are united by the most intimate analogy of languages. This analogy extends, as has been recently proved in the most evident manner, even to the inhabitants of the north-east of Asia; for the idiom of the Tschouktsches † at the mouth of the Anadir has the same roots, as the language of the Eskimoes who inhabit the coast of America opposite to Europe. The Tschouktsches are the Eskimoes of Asia. Like the Malays, this hyperborean race reside only on the seacoasts. They live on fish, and are almost all of a less stature than the other Americans, quick, lively, and talkative. Their hair is flat, straight, and black; but their skin (and this is very characteristic of that race, which I shall designate under the name of Tschougaz-Eskimoes,) is originally whitish. It

* Vater, in *Mithridates*, vol. iii, P. iii, p. 425—468, Egede, Crantz, Hearne, Mackenzie, Portlock, Chwostoff, Davidoff, Resanoff, Merk, and Billings, have described the great family of these Tschougaz-Eskimoes.

† I only mean here the Tschouktsches who have fixed dwelling places, for the wandering Tschouktsches approach very near the Coriacs.

is certain that the children of the Greenlanders are born white; some retain this whiteness; and often in the brownest (the most tanned) the redness of the blood is seen to appear on their cheeks*.

The second portion of the natives of America includes all those nations that are now Tschougaz-Eskimoes, beginning from Cook's River to the Straits of Magellan, from the Ugaljachmouzes and the Kinaëse of Mount St. Elias to the Puelches and Tehuelhets of the southern hemisphere. The men, who belong to this second branch, are taller, stronger, more warlike, and more taciturn. They present also very remarkable differences in the colour of their skin. In Mexico, Peru, New-Grenada, Quito, on the banks of the Oroonoko and the river of Amazons, in every part of South America, that I have examined, in the plains as well as on the coldest table-lands, the Indian children of two or three months old have the same bronze tint as is observed in adults. The idea that the natives may be whites tanned by the air and the sun, never presented itself to a Spanish inhabitant of Quito, or of the banks of the Oroonoko. In the north-east of America, on the contrary,

* *Crantz, Hist. of Greenland*, 1667, T. i, p. 132. Greenland does not seem to have been inhabited in the 11th century; at least the Eskimoes appeared only in the 14th, coming from the west. (Ib. p. 258.)

we meet with tribes among whom the children are white, and at the age of virility acquire the bronze colour of the natives of Mexico and Peru. Michikinakoua, the chief of the Miamis, had the arms, and the parts of the body not exposed to the sun, almost white. This difference of hue between the parts covered and not covered is never observed among the natives of Peru and Mexico, even in families that live much at their ease, and remain almost constantly within doors. To the west of the Miamis, on the coast opposite to Asia, among the Kolouches and Tchinkitans * of Norfolk Sound, the grown-up girls, when they are forced to wash their skin, display the white hue of the Europeans. This whiteness is found also, according to some accounts, † among the mountaineers of Chili.

These facts are very remarkable, and contrary to the opinion so generally spread of the extreme conformity of organization among

* Between 54° and 58° of latitude. These white nations have been visited successively by Portlock, Marchand, Baranoff, and Davidoff. The Tchinkitans, or Schinkit, are the inhabitants of the Island of Sitka. Vater, *Mithrid.*, vol. iii, P. 2, p. 218. Marchand, *Voy.*, V. ii, p. 167—170.

† Molina, *Saggio sulla Storia Nat. del Chili*, edit. 2, p. 293. Must we believe the existence of those blue eyes of the Boroas of Chili and Guayanas of Uruguay, represented to us as nations of the race of Odin? Azara, *Voy.* tom. ii, p. 76.

the natives of America. If we divide them into Eskimoes and *non* Eskimoes, we readily admit, that this classification is not more philosophical than that of the ancients, who saw in the whole habitable world only Celts and Scythians, Greeks and Barbarians. When the question however is to group nations without number, we gain something by proceeding in the mode of exclusion. All we have sought to establish here is, that, in separating the whole race of Tschougaz-Eskimoes, there remain still, among the coppery-brown Americans, other races, the children of which are born white, without our being able to prove, by going back as far as the history of the Conquest, that they have been mingled with European blood. This fact deserves to be cleared up by travellers, who, endowed with the knowledge of physiology, shall have opportunities of examining the brown children of the Mexicans at the age of two years, the white children of the Miamis, and those hordes* on the Oroonoko, who, living in the most sultry regions, retain during their whole life, and in the fullness of their strength, the whitish skin of the Mestizoes. The little communication that has hitherto existed between North America and the Spa-

* These whitish tribes are the Guaycas, the Ojos, and the Maquiritares.

nish Colonies has hindered the progress of all researches of this kind.

In man, the deviations from the common type of the whole race turn rather on the stature *, the physiognomy, or the form of the body, than on the colour. It is not so with animals, where varieties are found more in the colour, than in the form. The hair of the mammiferous kind, the feathers of birds, and even the scales of fish, change their hue, according to the lengthened influence of light and darkness, according to the intensity of the heat and cold. In man, the colouring matter seems to be deposited in the dermoidal system by the roots or the bulbs of the hair †; and all sound observations prove, that the skin varies in colour from the action of external stimuli on individuals, and not hereditarily in the whole race. The Eskimoes of Greenland and the Laplanders are tanned by the influence of the air; but their children are born white. We will not decide on the changes, which nature may produce in a space of time exceeding all historical traditions. Reason stops short in these matters,

* The circumpolar nations of the two continents are small and squat, though of races entirely different.

† According to the interesting researches of Mr. Gaultier, on the organization of the human skin, p. 57, John Hunter observes, that in several animals the coloration of the hair is independent of that of the skin.

when no longer under the guidance of experience and analogy.

The nations that have a white skin begin their cosmogony by white men; according to them, the Negroes and all tawny people have been blackened or embrowned by the excessive heat of the Sun. This theory, adopted by the Greeks*, though not without contradiction†, has been propagated even to our own times. Buffon has repeated in prose, what Theodectes had expressed in verse two thousand years before: "that the nations wear the livery of the climate they inhabit." If history had been written by black nations, they would have maintained what even Europeans have recently advanced‡, that man was originally black, or of a very tawny colour; and that he has whitened in some races, from the effect of civiliza-

* Strabo, liv. xv. (Oxford edition by Falconer, t. 11, p. 990.)

† Onesicritus, apud *Strabon.*, Lib. xv (*loc. cit.*, p. 983). Alexander's expedition appears to have contributed greatly to fix the attention of the Greeks on the great question of the influence of climates. They had learned from the account of travellers, that in Hindostan the nations of the south were of a darker colour than those of the north near the mountains; and they supposed, that they were both of the same race.

‡ See the work of Mr. Prichard, abounding with curious research. "Researches into the physical History of Man, 1813," p. 233—239.

tion and progressive debilitation, as animals, in a state of domestication, pass from dark to lighter colours. In plants and in animals, accidental varieties, formed under our own eyes, are become constant, and have been propagated* without alteration: but nothing proves, that in the present state of the human organization, the different races of black, yellow, copper-coloured, and white men, when they remain unmixed, deviate considerably from their primitive type by the influence of climates, of food, and other external agents.

I shall have occasion to return to these general considerations, when we shall ascend the vast table-lands of the Cordilleras, which are four or five times more elevated than the valley of Caripe. I shall here only cite the authority of Ulloa†. This learned man has seen the

* For example, the sheep with very short legs, called *ancon sheep* in Connecticut, and examined by Sir Everard Home. This variety dates only from the year 1791.

† "The Indians (Americans) are of a copper colour, which by the action of the sun and the air grows darker. I must remark, that neither heat nor cold produces any sensible change in the colour, so that the Indians of the Cordilleras of Peru are easily confounded with those of the hottest plains; and those who live under the line cannot be distinguished, by the colour, from those who inhabit the fortieth degree of north and south latitude." *Noticias Americ.*, cap. 17, p. 307. No ancient author has so clearly stated the two forms of reasoning, by which we still explain in our

Indians of Chili, of the Andes of Peru, of the burning coasts of Panama, and those of Louisiana, situate under the northern temperate zone. He had the good fortune to live at a period, when theories were less numerous; and, like me, he was struck at seeing the native, under the line, as much bronzed, as brown, in the cold climate of the Cordilleras, as in the plains. Where differences of colour are observed, they depend on the race. We shall soon find on the burning banks of the Oroonoko Indians with a whitish skin; *Est durans originis vis.*

days the differences of colour and figure among neighbouring nations, as Tacitus, in the Life of Agricola. He makes a just distinction between the influence of climate, and hereditary dispositions; and, like a philosopher persuaded of our profound ignorance of the origin of things, leaves the question undecided. *Habitus corporum varii atque ex eo argumenta. Seu durante originis vi, seu procurrentibus in diversa terris, positio cœli corporibus habitum dedit.* Agricola, Cap. II.

NOTES TO THE THIRD BOOK.

NOTE A.

I will give here a list of the grammars of American languages, that I brought to Europe, and which have recently excited the interest of the learned by the investigations of Messrs. Hervas, Gili, Barton, Vater, and Schlegel.

Bernardo de Lugo, gramatica de la lengua del Nuevo Reyno de Granada o de la lengua de los Muyzcas o Mozcas. Madrid, 1619.

Diego Gonzalez Holguin, Vocabulario de la lengua general de todo el Peru, llamada lengua Qquichua o del Inca, conforme a la propriedad cortesana del Cuzco. Ciudad de los Reyes, 1608.

Gramatica de la lengua del Inca. Lima, 1753.

Al. de Molina, Vocabulario de la lengua Mexicana. Mexico, 1571.

Augustin de Vetancurt, Arte de la lengua Mexicana. Mexico, 1673.

Ant. Vasquez Gastelu y Raym. de Figueroa, arte de lengua Mexicana. Puebla de los Angeles, 1693.

L. de Neve y Molina, Reglas de ortografia, Diccionario y arte del idioma Othomi. Mexico, 1767.

Carlos de Tapia Zenteno, Noticia de la lengua Huasteca, con doctrina christiana. Mexico, 1767.

Fr. Antonio de los Reyes, Gramatica de la lengua Mixteca. Mexico, 1593.

Jose Zambrano Bonilla, cura de San Andres de Hucitlapan, arte de la lengua Totonaca, con una doctrina de la len-

gua de Naolingo, con algunas voces de la lengua de aquel sierra y de esta por aca, por Franc. Dominguez, cura de Xalpan. Puebla de los Angeles, 1752.

Jose de Ortega, Vocabulario della lengua Castellana y Cora. Mexico, 1732.

Fern. Ximenez, Gramatica de la lengua Caribe. (Manuscript.)

My brother, Mr. William de Humboldt, who has profoundly studied the American languages, has enriched this collection with the following works.

C. de Tapia Zenteno, arte novissima de lengua Mexicana. Mexico, 1753.

Raymond Breton, Dict. Caraibe-François. Auxerre, 1665.

Dictionnaire Galibi, par M. D. L. S. Paris, 1763.

Luiz Figueira, Gramatica de la lengua del Bresil. Lisboa, 1795.

Lexic. Bras. Lisb. 1795.

He has also in his possession fourteen manuscripts, copied from those of the Abbé Hervas, and of the Propaganda at Rome: 1. MSS. on the Azteck or Mexican language. 2. MSS. on the language of the Otomites. 3. MSS. on the Maya or Yucatan language. 4. MSS. on the language of the Oroonoko in general. 5. MSS. on the languages of the Yaruroes. 6. MSS. on the Betoy language. 7. MSS. on the Omagua language. 8. MSS. on the Qquichua language by Father Camano. 9. MSS. on the Guarani tongue. 10. MSS. on the Guaicuru or Mbaya language. 11. MSS. on the Mocobi language. 12. MSS. on the Lule language. 13. MSS. on the language of the Abiponians. 14. MSS. on the language of the Araucans of Chili. This list contains more than thirty American languages, that have been reduced into grammars for the use of the missionary monks. It appeared to me so much the more useful to give it here, as the richest libraries of Europe, for instance that of the King at Paris, do not contain three grammars of Spanish American languages.

NOTE B.

Language of the Chaymas in the Missions of Caripe.

U-re, I, myself.
Eure, you.
Teure, he, him.
Teurecon, themselves.
Uchere, me also.
Euya, to you.
Toya, perhaps, *teuya*, to him.
Taquer, with him.
Uca or *uguarey*, like me.
Ucarepra, not like me.
Muene, *muenere*, that.
Temerene, all that.
Tibinpupra, one only.
Achacono, both.
Achoroaono, all three.
Ucheepchic, *ucheucurca*, myself, *in insisting*, myself without doubt.
Taquer, with him.
Upuyao or *upunyao*, for me.
Guaz, I am, (*az*, to be; *g-u* me, *thus*, me to be).
Pra, no, not.
Zis, sun,
Nuna, moon.
Septuca, Venus.
Vilaborei, the Pleiades.
Apotos, fire.
Tuna, water.
Conopo, rain, shower.
Pesissi, wind.
Mico, child.
Ures, girl.
Urajot, boy.
Iguanetpur or *ipuetepuin*, widower.
Ipuetepur, widow.
Tuguerizquen, the bridegroom.
Tuanequen, the bride.
Ye, tree *or* wood.
Caney, a shed.
Chinchorro, hammock.
Uguemur, fever.
Notomocan, that is done.
Panaz or *paremana*, that is enough.
Ucaymuer, *uguozpar*, or *uguozuar*, my game, what I have killed.
Eniri, *eneritpur*, or *enerizpo*, your work.
Piache, magician, physician.
Ivorokiamo, devil, evil spirit.
Chavi, tiger, jaguar.
Chavinaci, descending from a tiger, a figurative expression meaning a cruel man.
Totelelo, cock.
Focora, hen.
Cuivivi, duck.

Tucuchi, humming-bird.
Sicotu, chigoe, pulex penetrans.
Bututo, pronouncing the *b* nearly as an *f*, flute.
Camo, to sing.
Tandema, to morrow.
Chuque take, imperative.
Pisca, carry, imperative.
Tropse, he bursts.
Kesoptreipnei, he is ill.
Ispinkepolepi, it is hot.
Tenetkinpoli, it is cold.
Nesselcane, it thunders.
Tinpole poc maney, it rains already.
Mico nis-inimipani, a child is born.
Tuquerizque camanay, or *tuputcamanay?* are you married? (masc.)
Tuanecccamanay, are you married? (fem.)
Tuguerizqueguaz, I am married. (masc.)
Tuaniqueguaz, I am married. (fem.)
Iguanepuin uze, or *iguanepra*, I am a widow.
Iguirichipraguaz, or *ipuitepra*, I am a widower.
Iguanetac, marry, speaking to a woman.
Ipuetetac, marry, speaking to a man.
Epuitpe nechia meche, let this person be your wife.
Tupaguenapiaz, I have eaten enough.
Epuequere, for you.
Cupuncomiao, or *cupuecon*, or *cupuerecon*, for us.
Ipuec ipagua, he is with him.
Onquepan, or *aponomac*, give me more.
Guarepanca, I will carry more.
Epuec charpe guaz, I am merry with you.
Apazcatepayene, he likes to kill.
Notomocan, that is done.
Guanatpuec, he cultivates his garden.
Quenapuinuze, I have not seen him.
Ayaz yecran, the maize is getting wet.
Tecreguez, it is slippery.
Imoron, or *imoromnique*, poisoner.
Turopiurpuec, he is dying.
Yarazinyao or *tarazincomiao*, he will be afraid.
Nunenao, by moon-light.
Eyepatechin, they must learn
Etatechin, they must hear.
Enertechin, they must do.
Uyare onquepe, give me also.
Amachenepque go and bring me.

Amna zezin, or *enzez*, let us go.
Etigua? what is that?
Mananequian, he is called.
Ipunet, he chooses it.
Anec narepo, who has seen him?
Guayque cumuepo, or *cumuepuec*, they are going to kill game.
Zazamar, road.
Conopyaune, or *conopyayere*, in the time of the shower.
Quenpotupra quoguaz, I do not know him.
Quenepra quoguaz, I have not seen him.
Terepuirpuec, why is he frightened?
Turayerpuec, because of the disease.
Chetayma, within.
Cumuerivian, he wanted to beat him.
Upatay guane mana, there is honey in my hut.
Tumanemia, always dancing.
Utechirin, I will go also.
Mazpantonoma apotpaca itumuecon, the wicked only will go into the fire.
Patre Cumanantacanan, is the father at Cumana?
Cumanantacamana, yes, he is at Cumana.
Montaonocon, or *taronocon*, those of this place.
Miyonocon, those of that place below.
Yequiz puec capucmiaz, I tied him to the tree.

NOTE C.

When Christopher Columbus returned from his third voyage, a vague report was spread throughout all Europe, that he had discovered by certain movements of the polar star, that the coast of Paria and the neighbouring sea were elevated like a vast table-land; that the Earth was not perfectly round, but that (in the western countries) it had a rising toward the equator; that travellers ascended, in going from Cadiz to the peninsula of Paria, and that owing to the greater elevation of these lands, Paria had a less burning climate, and a race of men less darkly coloured, than those of

Africa. These singular hypotheses are mentioned by all the Historians of that time. (Pet. Martyr, *Ocean.*, Dec. 1, lib. vii, p. 77. Gomara, *Hist. gen.*, cap. viii, p. 110. Herrera, Dec. 1, lib. iii, cap. xii.)

But what observation of the polar star could induce Christopher Columbus to adopt such strange ideas? Ferdinand Columbus explains this in the life of his father (Churchill's Collection, Vol. ii, p. 583). The admiral had observed, in the latitude of the Azores, the meridian altitude of the polar star above and below the pole. The difference of these two altitudes was 5°; and this gave 2° 30′ for the distance of the star from the pole; while, by a trigonometric calculation, it ought to have been at that time 3° 24′ 30″. There was an error therefore of 54′ *minus*. Columbus judged of the passage of the star over the meridian by the position of the Great Bear. When the wain was east, or west, he considered it as indicating the passage of the star over the meridian; but this indication being very uncertain, Columbus was not sure of observing when the polar star was in the meridian; the inferior altitude must have been too great, and the superior too little; and this explains why Columbus found a difference of 5° only between the two altitudes.

Under the torrid zone, at about 7° or 8° of N. latitude, he found the pole star 11° above the horizon, at it's superior meridian, and only six when it was in declination, or at the altitude of the pole, which gave him a polar distance of 5°. Here Columbus supposed again, that the pole star was in the superior meridian, when the wain was in the west; but as he could not perceive the pole star at it's inferior meridian, because it was too low, he observed the altitude when the wain was in the superior meridian, and indicated the declination of the star. The pole star appeared to him again at the altitude of 9°, when the wain was in the inferior meridian and consequently not visible, because of the small elevation of the pole.

If the constellation did not indicate with precision the

passages of the polestar over the meridian, it appears, that the indications it gave of the declinations were still less exact; for it is very probable, that Columbus took the altitude of the polestar when it was below the declination and the pole, and therefore found too small an altitude, and a polar distance of 5° instead of 2° 30′, which he had deduced from his observations in the Azores. In order to explain so great a difference, he imagined, that the Earth had the form not of a *pincushion* but of a *pear*; and that mariners ascended prodigiously toward the sky, in going from the Azores to Paria, where the circle described by the polestar must appear very large, because it was seen from a nearer place. "Though I am not," says he, "quite master of my explanation, the star appears in it's full orbit at the equator, while the nearer we approach the pole, the more this orbit diminishes, because of the obliquity of the sky." All this is not calculated to give us a favourable idea of the astronomical knowledge of Columbus. Is it possible that so great a man had not more rational notions of the distance and apparent motions of the stars? The Admiral relates, that while he was at Paria, he had an inflammation in the eyes. Perhaps he observed worse than usual, or entered in his journal the observations of his pilots. Perhaps too the son has given a confused account of the ideas of his father. Gomara blames the Admiral for having imagined that Paria is nearer the sky than Spain. "The Earth," says he, "is round, and not of the figure of a pear. This false opinion of Columbus has maintained it's ground to our own days, and makes some unlearned pilots believe, that from India and Paria to Spain they descend to come to Europe, *cuesta abaxo*." Peter Martyr d'Anghiera judges also the Admiral with great sevetity, "quæ de poli varietate refert Colonus, contra omnium astronomorum sententiam prolata videntur."

BOOK IV.

CHAPTER X.

Second abode at Cumana. — Earthquakes. — Extraordinary meteors.

We remained a month longer at Cumana. The voyage which we were going to undertake on the Oroonoko and the Rio Negro required preparations of every kind. We had to choose the instruments, that could be most easily transported in narrow boats; and to furnish ourselves with guides for an inland journey of ten months, across a country which is without communication with the coasts. The astronomical determination of places being the most important object of this undertaking, I felt greatly interested in not missing the observation of an eclipse of the Sun, which was to be visible at the end of the month of October: and in consequence I preferred remaining till that period

at Cumana, where the sky is generally clear and serene. We had not sufficient time to reach the banks of the Oroonoko; and the high vallies of Caraccas promised less favourable opportunities, on account of the vapours that accumulate around the neighbouring mountains. In fixing with precision the longitude of Cumana, I had a point of departure for the chronometrical determination of longitudes on which alone I could depend, when I did not stop long enough to take lunar distances, or observe the satellites of Jupiter.

I found myself however near being compelled by a fatal accident, to renounce, or at least to delay for a long time, my journey to the Oroonoko. On the 27th of October, the day before the eclipse, we went as usual, to take the air, on the border of the Gulf, and to observe the instant of high water, which in those parts is only twelve or thirteen inches. It was eight in the evening, and the breeze did not yet blow. The sky was cloudy; and during a dead calm it was excessively hot. We crossed the beach, which separates the suburb of the Guayqueria Indians from the landing place. I heard some one walking behind me, and on turning, I saw a tall man of the colour of the Zamboes, naked to the waist. He held almost over my head a *macana*, a great stick of palm-tree wood, enlarged toward the end like a club. I avoided

the stroke by leaping toward the left hand. Mr. Bonpland, who walked on my right, was less fortunate. He did not see the Zambo so soon as I did, and received a stroke above the temple, that levelled him with the ground. We were alone, without arms, half a league from any habitation, on a vast plain bounded by the sea. The Zambo, instead of attacking me, moved off slowly to lay hold of Mr. Bonpland's hat, which, after somewhat deadening the violence of the blow, had fallen at a distance. Affrighted at seeing my companion on the ground, and for some moments senseless, I thought of him only. I helped him to raise himself, and pain and anger doubled his strength. We ran toward the Zambo, who, either from cowardice, common enough in this cast, or because he perceived at a distance some men on the beach, did not wait for us, but ran off toward the *Tunal*, a little thicket of cactus and arborescent avicennia. He chanced to fall in running; Mr. Bonpland, who reached him first, seized him round the body, and exposed himself to the most imminent danger. The Zambo drew a long knife from his pantaloons, and in this unequal struggle we should infallibly have been wounded, if some Biscayan merchants, who were taking the air on the beach, had not come to our assistance. The Zambo seeing himself surrounded, thought no longer of de

fence; he escaped again, and after following him through the thorny cactuses, he took shelter, as if wearied, in a cowhouse, whence he suffered himself to be quietly led to prison.

Mr. Bonpland had a fever during the night; but of a stout heart, and possessing that cheerful character, which a traveller ought to consider as one of the most precious gifts of nature, he continued his labours the next day. The stroke of the *macana* had extended to the top of his head, and he felt it's effects two or three months during the stay he made at Caraccas. In stooping to collect plants, he was sometimes seized with a giddiness, which led us to fear that an internal abscess was forming. Happily these apprehensions were unfounded, and symptoms, at first so alarming, gradually disappeared. The inhabitants of Cumana showed us the warmest marks of their concern. We learnt, that the Zambo was a native of one of the Indian villages, which surround the great lake of Maracaybo. He had served on board a privateer belonging to the Island of St. Domingo, and in consequence of a quarrel with the Captain, he had been left on the coast of Cumana, when the ship quitted the port. Having seen the signal which we had placed to observe the height of the tides, he had watched the moment when he could attack us on the beach. But why, after having knocked one of us down, was he

satisfied with simply stealing a hat? In an examination he underwent, his answers were so confused and stupid, that it was impossible to clear up our doubts. Most frequently he maintained, that his intention was not to rob us; but that, irritated by the bad treatment he had suffered on board the privateer of St. Domingo, he had not been able to resist the desire of doing us mischief, when he heard us speak French. Justice being so slow in this country, that the prisoners, of which the jail is full, remain seven or eight years without being able to obtain a trial, we learnt with some satisfaction, that a few days after our departure from Cumana, the Zambo had succeeded in breaking out of the Castle of St. Antonio.

In spite of Mr. Bonpland's accident, I was the next day, the 28th of October, at five in the morning, on the terrace of our house, making preparations for the observation of the eclipse. The weather was fine and serene. The crescent of Venus, and the constellation of the Ship, so splendid from the disposition of it's immense nebulæ, were lost in the rays of the rising sun. I had the greater reason to congratulate myself on so fine a day, as during several weeks the storms, which had regularly gathered to the south and south-east, two or three hours after the passage of the Sun over the meridian, had prevented me from regulating the time-keepers

by corresponding altitudes: and at night, one of those reddish vapours, which do not affect the hygrometer in the lower regions of the atmosphere, veiled the stars.

This phenomenon was the more extraordinary, as in other years it often happens, during three or four months, no trace of clouds or vapours is to be seen. I had a complete observation of the progress and of the end of the eclipse. I determined the distance of the horns, or the differences of altitudes and azimuth, by the passage over the threads of the quadrant. The end of the eclipse was at $2^h\ 14'\ 23{\cdot}4''$, mean time at Cumana. The result of my observation, calculated according to the ancient tables, by Mr. Ciccolini at Bologna, and by Mr. Triesnecker at Vienna, has been published in the *Connoissance des Temps**. This result did not differ less than 1′ 9″ in time from the longitude I had determined by the chronometer; but calculated afresh by Mr. Oltmanns, by the new lunar tables of Burg, and the solar tables of Delambre, the eclipse and the chronometer agreed to 10″ nearly. I cite this remarkable instance of an error reduced to one seventh by the use of the new tables, to remind travellers how much it is their interest to note and publish the most minute details of their

* Year 9, p. 142. Zach, *Mon. Corresp.*, Vol. i, p. 596. (See also note A. at the end of this fourth book.)

partial observations. The perfect concordance that I observed on the spot, between the satellites of Jupiter and the chronometrical results, inspired me with great confidence in the going of the time-keeper by Louis Berthoud, whenever it was not exposed to the violent jolting of the mules *.

The days which preceded and followed the eclipse of the Sun displayed very remarkable atmospherical phenomena. It was what is called in those countries the season of winter; that is, of clouds and small electrical showers. From the 10th of October to the 3d of November, at nightfall, a reddish vapour arose in the horizon, and covered in a few minutes, with a thicker or thinner veil, the azure vault of the sky. Saussure's hygrometer †, far from indi-

* The following are the results of the whole of the observations of the longitude made at Cumana in 1799 and 1800.

By the timekeeper as regulated at Corunna	4h 26′ 4″
By 10 immersions and emersions of the Satellites - - - - - -	- 4 26 6
By lunar distances - - - -	- 4 25 32
By the eclipse of the sun - - -	- 4 25 55
Longitude of Cumana - - - -	- 4 25 54

See my Astronomical Obs., Vol. i, p. 64—86.

† It must be remembered, that in this latitude, at times when it never rains, Saussure's hygrometer remains commonly between 85° and 90°, the temperature being from 25° to 30°. In Europe in the month of August, with the same degree of

cating greater humidity, often went back from 90° to 83°. The heat of the day was from 28° to 32°, which for this part of the torrid zone is very considerable. Sometimes in the midst of the night the vapours disappeared in an instant; and at the moment when I had arranged my instruments, clouds of a brilliant whiteness were formed at the zenith, and extended toward the horizon. On the 18th of October, these clouds were so remarkably transparent, that they did not hide stars even of the fourth magnitude. I distinguished so perfectly the spots of the moon, that it might have been thought that it's disk was placed before the clouds. They were at a prodigious height, disposed in bands, and at equal distances, as from the effect of electric repulsions. These are the same small masses of vapour, which I saw above my head on the ridge of the highest Andes, and which in several languages bear the name of *sheep*. When the reddish vapour was spread lightly over the sky, the great stars, which in general at Cumana scarcely twinkle below 20° or 25°, do not retain even at the zenith their steady and planetary light. They twinkled at all altitudes, as after a heavy storm of rain*. I was

heat, the mean moisture of the atmosphere is from 78° to 80°.

* I have not observed any direct relation between the twinkling of the stars, and the dryness of thatp art of the

struck with this effect of a fog, which did not affect the hygrometer at the surface of the Earth. I remained a part of the night seated in a balcony, from which I had a view of a great part of the horizon. In every climate I find a particular attraction in fixing my eyes, when the sky is serene, on some great constellation, and seeing groups of vesicular vapours appear and augment, as around a central nucleus, and then disappear, and form themselves anew.

From the 28th of October to the 3d of November, the reddish fog was thicker than it had yet been. The heat of the nights seemed stifling, though the thermometer rose only to 26°. The breeze, which generally cooled the air from eight or nine o'clock in the evening, was no longer felt. The atmosphere appeared as if it were on fire. The ground, parched and dusty,

atmosphere open to our researches. I have often seen at Cumana a great twinkling of the stars of Orion and Sagittarius, when Saussure's hygrometer was at 85°. At other times these same stars, considerably elevated above the horizon, emitted a steady and planetary light, the hygrometer being at 90° or 93°. It is probably not the quantity of vapour, but the manner in which it is diffused, and more or less dissolved in the air, that determines the twinkling, invariably attended with a coloration of light. It is remarkable enough, that in northern countries, at a time when the atmosphere appears perfectly dry, the twinkling is stronger in very cold weather.

was cracked on every side. On the 4th of November, about two in the afternoon, large clouds of an extraordinary blackness enveloped the high mountains of the Brigantine and Tataraqual. They extended by degrees as far as the zenith. About four in the afternoon, thunder was heard over our heads, but at an immense height, without rolling, and with a hoarse and often interrupted sound. At the moment of the strongest electric explosion, at $4^h 12'$, there were two shocks of an earthquake, which followed at fifteen seconds distance from each other. The people in the streets filled the air with their cries. Mr. Bonpland, who was leaning over a table examining plants, was almost thrown on the floor. I felt the shock very strongly, though I was lying in a hammock. It's direction was from north to south, which is rare at Cumana. Slaves, who were drawing water from a well more than eighteen or twenty feet deep, near the river Manzanares *, heard a noise like the explosion of a strong charge of gunpowder. The noise seemed to come from the bottom of the well, a very singular phenomenon, though very common in the greater part of the countries of America exposed to earthquakes.

* In the plantation (*chara*) of the colonel of artillery, Don Antonio Montana. See Ch. iv, Vol. ii, p. 227.

A few minutes before the first shock, there was a very violent blast of wind, followed by an electrical rain in great drops. I immediately tried the atmospherical electricity by the electrometer of Volta. The small balls separated four lines ; the electricity often changed from positive to negative, as is the case during storms, and, in the north of Europe, even sometimes in a fall of snow. The sky remained cloudy, and the blast of wind was followed by a dead calm, which lasted all night. The setting of the Sun presented a scene of extraordinary magnificence. The thick veil of the clouds was rent asunder as in shreds quite near the horizon : the Sun appeared at 12° degrees of altitude on a firmament of indigo-blue. It's disk was enormously enlarged, distorted, and undulated toward the edges. The clouds were gilded; and fasciculi of divergent rays, which reflected the most brilliant colours of the rainbow, extended even to the midst of the heavens. There was a great crowd in the public square. This phenomenon, the earthquake, the clap of thunder which had accompanied it, the red vapour seen during so many days, all was regarded as the effect of the eclipse.

About nine in the evening there was a third shock, much slighter than the former two, but attended evidently with a subterraneous noise. The barometer was a little lower than

usual *; but the progress of the horary vari-

* The 4th of November, 1799 - - Barometer.

	Lines.
9 o'clock in the morning - -	336·83
4 - - in the evening - -	336·04
4 30′ - - - - - -	335·92
11 - - - - - - -	336·42
The 5th of November.	
9 o'clock in the morning - -	337·02
10 - - - - - - -	337·00
1 - - in the afternoon -	336·72
3 - - - - - - -	336·25
4 - - - - - - -	336·20
4 30′ - - - - - -	336·52
11 - - - - - - -	336·86
The 6th of November.	
1 in the morning - - -	336·32
4 30′ - - - - - -	336·28

The 18th of August I was struck at finding the absolute height of the barometer a little less than usual. There were that day eleven strong shocks of an earthquake at Carupano, 22 leagues east from Cumana. On the 25th a small shock was felt at Cumana, and the barometric height was the same as usual. During these two phenomena, the atmospheric tides were equally regular; only on the 25th of August their magnitude was much less considerable. I shall insert the three observations made by Mr. Bonpland and myself in each day.

	9 in the morn.	4 30′ in the aftern.	11 at night.
August 18th.	336·85	335·92	336·75
25th.	337·01	336·80	337·00
26th.	337·50	336·42	337·10
27th.	337·18	336·51	336·87

These examples confirm what I have said above on the invariability of the atmospheric tides during the shocks. See Chap. iv, Vol. ii, p. 224.

ations or small atmospheric tides, was no way interrupted. The mercury was precisely at the *minimum* of height at the moment of the earthquake; it continued rising till eleven in the evening, and sunk again till half after four in the morning, conformably to the law which regulates the barometrical variations. In the night between the 3d and 4th of November, the reddish vapour was so thick, that I could not distinguish the place of the moon, except by a beautiful halo of 20° diameter.

It was scarcely twenty-two months since the town of Cumana had been almost totally destroyed by an earthquake. The people look on the vapours, which darken the horizon, and the failure of the breeze during the night, as prognostics infallibly disastrous. We had frequent visits from persons, who wished to know if our instruments indicated new shocks for the next day. The inquietude was particularly great and general, when on the 5th of November, exactly at the same hour as the preceding day, there was a violent gust of wind, attended by thunder, and a few drops of rain. No shock was felt. The wind and storm returned for five or six days at the same hour, almost at the same minute. The inhabitants of Cumana, and of many other places between the tropics, have long ago made the observation, that those atmospherical changes, which appear the most

accidental, follow for whole weeks a certain type with astonishing regularity. The same phenomenon exists in summer, under the temperate zone; nor has it escaped the sagacity of astronomers, who often see clouds form in a serene sky, during three or four days together, at the same part of the firmament, take the same direction, and dissolve at the same height; sometimes before, sometimes after the passage of a star over the meridian, consequently within a few minutes of the same point of *apparent time* *.

The earthquake of the 4th of November, the first I had felt, made so much the more lively an impression on me, as it was accompanied with remarkable meteorological variations. It was moreover a real lifting up, and not a shock by undulations. I did not then imagine, that after a long abode on the table-lands of Quito and the coasts of Peru, I should become almost as familiar with the abrupt movements of the ground, as we are in Europe with the noise of thunder. We did not think of rising at night, in the city of Quito, when subterraneous rumblings *(bramidos)*, which seem always to come from the volcano of Pichincha, announced, (two

* Mr. Arago and I paid a great deal of attention to this phenomenon during a long series of observations made in the years 1809 and 1810, at the Observatory of Paris, to verify the declination of the stars.

or three, and sometimes seven or eight minutes beforehand) a shock; the force of which is seldom in proportion to the intensity of the noise. The carelessness of the inhabitants, who recollect that for three centuries past their city has not been overwhelmed, communicates itself easily to the least intrepid traveller. In general it is not so much the fear of the danger, as the novelty of the sensation, that strikes so forcibly, when the effect of the slightest earthquake is felt for the first time.

From our infancy, the idea of certain contrasts fixes itself in our minds: water appears to us an element that moves; earth, a motionless and inert mass. These ideas are the effect of daily experience; they are connected with every thing that is transmitted to us by the senses. When a shock is felt, when the earth is shaken on it's old foundations, which we had deemed so stable, one instant is sufficient to destroy long illusions. It is like awakening from a dream; but a painful awakening. We feel, that we have been deceived by the apparent calm of nature; we become attentive to the least noise; we mistrust for the first time a soil, on which we had so long placed our feet with confidence. If the shocks be repeated, if they become frequent during several successive days, the uncertainty quickly disappears. In 1784, the inhabitants of Mexico were accus-

tomed to hear the thunder roll beneath their feet *, as it is heard by us in the region of the clouds. Confidence easily springs up in the human breast, and we end by accustoming ourselves on the coast of Peru to the undulations of the ground, like the sailor to the tossings of the ship, caused by the motion of the waves.

The earthquake of the 4th of November appeared to me, to have had a sensible influence on the magnetical phenomena. In a short time after my arrival on the coasts of Cumana, I had found the dip of the needle 43·53° of the centesimal division. Some days before the earthquakes, I was occupied very assiduously in verifying this result. The governor of Cumana, who was in possession of several scientific books, had lent me the interesting *Tratado de Navegacion* of Mendoza. I was struck with the assertion there made †, "that the monthly and horary fluctuation of the dip of the needle is greater than that of the magnetic variation." A series of observations, which I had made in 1798, conjointly with the Chevalier Borda at Paris, and afterwards by myself at Marseilles and Madrid, convinced me, that the diurnal variations could not be perceived in the best

* *Los bramidos de Guanazuato.* See vol. ii, ch. iv, p. 228.

† Vol. ii, p. 72.

dipping compasses; that, if they exist (as we must suppose) they do not exceed eight or ten minutes*; and that the far more considerable horary changes, mentioned by different authors, should be attributed to the imperfect levelling of the instrument. In spite of these well founded doubts, I did not hesitate on the first of November, to place Borda's great dipping apparatus in a spot well calculated for delicate experiments of this nature. The dip was invariably 43·65°. This quantity was the mean of many observations made with the greatest care. On the 7th of November, three days after the violent shocks of the earthquake, I recommenced the same series of observations, and was astonished to find, that the dip became less by 90 centesimal minutes. It was no more than 42·75°. I thought, that perhaps it would again augment, and return progressively to it's first state; but I was disappointed in my expectation. A twelvemonth after, on my return from the Oroonoko, I still found the dip of the magnetic needle at Cumana to be 42·80°; though the intensity of the magnetic forces had remained the same before and after the earth-

* The annual changes of the magnetic dip appear in our climates to be from four to five minutes; but, according to the analogy of the daily and annual changes of the variation, we are not indispensably obliged to admit, that the daily changes are less considerable than the annual.

quake. This was expressed by 229 oscillations in 10 minutes of time, when at Madrid it was 240, at Paris 245. On the 7th of November I ascertained the magnetic variation; which I found to be 4° 13′ 50″ east. I had found it before the earthquake, at different hours of the day, from five to six minutes greater and less. The horary variations conceal the effects of changes in the variation, when these are not very considerable.

Reflecting on the whole of these magnetical phenomena *, I am not aware of any cause of error, that could have changed the result of my observations of the dip, made before the 4th of November. I employed the same precautions, I did not change the place of the instrument †, and I noted in my journal the particulars of each observation. It is indeed very remarkable, that the needle kept with the greatest care in oiled paper, after a journey of seven hundred leagues, on our return to Cumana gave, on taking a mean of fifteen observations,

* On the 28th of August, 1799, dip toward the east, 42·97°; toward the west, 44·10°. On the first of Nov., east 43·10°; west 44·20°. On the 7th of Nov., east 42·15°; west 43·35°. On the 5th of September, 1800, east 42·20°; west 43·40°.

† Mr. Gay-Lussac and myself found in 1805, changing the poles in each place, at Milan 66° 43′ in the town, and in a field near the town, 65° 36′, of the old division.

the same dip, within five centesimal minutes, as immediately after the earthquake. I did not indeed change the poles of the magnet, at each observation, as I have done since in a long series of dips determined conjointly with Mr. Gay-Lussac, in 1805, and 1806, in France, Italy, Switzerland, and Germany; and as the astronomers did constantly in Captain Cook's second Voyage. This operation is long and delicate, when we are almost always obliged to make our observations in the open air. On leaving Europe, the Chevalier Borda advised me to deprive the needle of it's magnetic power only after certain intervals, and to take note of the differences. These differences did not amount, in the experiments made with Mr. Lenoir at Paris, to more than 12 minutes; and at Mexico, in different trials, to 8, 15, 6, and 10 minutes: the needle too, which was of well-tempered steel, retained it's full polish during five years. Besides, in the phenomenon of which we are treating, the question relates only to a change of apparent dip, not to an absolute quantity. Not having touched the needle, I do not see the probability of an error of a centesimal degree.

It is well known that the shock, in modifying the position of the particles of iron, cobalt, or nickel, modifies also their magnetic properties; that it is capable of giving polarity, and some-

times even of changing the poles. When I described the magnetic axes of a great mountain of *polarized* serpentine, situate on the north of Baireuth, in Franconia, Mr. Lichtenberg, the celebrated naturalist of Gottingen, conjectured, that these axes might possibly be the effect of earthquakes, which, in the great catastrophe of our planet, had acted for a long time in the same direction. We know, by the recent experiments of Mr. Haüy, that, if heat diminish the magnetic charge, it can also sometimes give certain substances *, in which iron is combined with other principles, the power of being attracted by the magnet. We may thereby conceive, to a certain point, how earthquakes and volcanic agents, by the changes they produce in the interior of the globe, at great depths, may modify the magnetic phenomena, which we observe at it's surface. I shall not insist on such vague conjectures, but shall confine myself to the simple observation, that, at the periods when we felt such violent and frequent shocks in the Cordilleras of Quito, and on the coast of Peru, we were never able to discover any accidental variation in the magnetic dip. It is true, that the analogous changes, produced by the aurora-borealis in the variation of the needle, like those which I have imagined I re-

* For example, sulphuretted iron and arseniated pyrites.

marked in the intensity of the forces, are observed only from time to time; they are also transitory, and cease with the duration of the phenomenon.

The reddish vapour, which spread a mist over the horizon a little before the setting of the Sun, had ceased since the 7th of November. The atmosphere returned to it's former purity, and the vault of the skies appeared at the zenith of that deep blue tint, which is peculiar to climates where the heat, the light, and a great equality of electric charge seem at once to combine to promote the most perfect dissolution of water in the air. I observed, on the night of the 7th, the immersion of the second satellite of Jupiter *. The belts of the planet were more distinct than I had ever seen them before.

I passed a part of the night in comparing the intensity of the light emitted by the beautiful stars, that shine in the southern sky. I pursued this task carefully at sea, and during my abode at Lima, at Guayaquil, and at Mexico, in both hemispheres. Near half a century has elapsed, since La Caille examined

* I observed it at $11^h\ 25'\ 6''$ mean time, whence on comparing my observation with those of Viviers and Marseilles, the long. of Cumana comes out $4°\ 26'\ 6''$. (Obs. Ast., vol. i, p. 79.)

this region of the sky, which is invisible in Europe. The stars near the south pole are observed in general with so little perseverance and assiduity, that the greatest changes may take place in the intensity of their light, and their own motion, without astronomers having the slightest knowledge of them. I think I have remarked changes of this kind in the constellation of the Crane, and in that of the Ship Argo. I compared at first with the naked eye the stars which are not very distant from each other, in order to class them according to the method pointed out by Mr. Herschell *, in a paper read to the Royal Society of London in 1796. I afterwards employed diaphragms diminishing the aperture of the telescope, and coloured and colourless glasses placed before the eye-glass; and more particularly an instrument of reflexion calculated to bring at the same time two stars into the field of the telescope, after having equalized their light by receiving it with more or fewer rays at pleasure, reflected by the quicksilvered part of the mirror. I admit, that all these photometric processes are not of great precision; but I believe, that the last, which perhaps had never before been

* Phil. Trans. for 1796, p. 166. (Compare also Pigott and Goodrich in the *Trans.*, vol. lxxv, Part 1. p. 127, 154, and vol lxxvi, Part 1, p. 197.)

employed, might be rendered nearly exact, by adding a scale of equal parts to the moveable frame of the telescope of the sextant. It was by taking the mean of a great number of valuations, that I saw the relative intensity of the light of the great stars decrease in the following manner: Sirius, Canopus, α Centauri, Achernar, β Centauri, Fomalhaut, Rigel, Procyon, Betelgueuse, ε of the Great Dog, δ of the Great Dog, α of the Crane, α of the Peacock. These experiments of which I have published elsewhere the numerical results *, will become more interesting, when travellers shall have determined afresh, at intervals of forty or fifty years, some of those changes, which the celestial bodies seem to experience, either at their surface, or in their distances from our planetary system.

When we have observed for a long time with the same instruments, in our northern climates, and under the torrid zone, we are surprised at the effect produced in the latter by the transparency of the air, and the less extinction of light, on the clearness with which the double stars, the satellites of Jupiter, or certain nebulæ present themselves. Beneath a sky equally serene in appearance, it would seem as if more

* See note C at the end of this volume, and my Astron. Obs., vol. i, p. 71.

perfect instruments were employed; so much more distinct and well defined do the objects appear between the tropics. It cannot be doubted, that at the period when equinoxial America shall become the centre of a great civilization, physical astronomy will make immense improvements, in proportion as the skies will be explored with excellent glasses, in the dry and burning climates of Cumana, Coro, and the Island of Margaretta. I do not here mention the ridge of the Cordilleras, because, with the exception of some high and nearly barren plains in Mexico and Peru, the very elevated table-lands, in which the barometric pressure is from ten to twelve inches * less than at the level of the sea, possess a foggy and extremely variable climate. A great pureness of the atmosphere, such as prevails constantly in the low regions during the dry season, compen-

* From 27 to 30 centimetres; for example, the plains that surronnd the volcano of Cotopaxi, between the farm of Pansache and Pumaurcu; the plains of Chusulongo on the declivity of Antisana; and on Chimborazo the plain above the *Black Lake*, in Peruvian *Yanacocha.* According to the formulæ of *La Mécanique Céleste* of Laplace, the extinction of light at the elevation of these plains is 9993; at the top of Chimborazo, 9989; at the top of the highest mountain of the Himalaya (supposing it with Mr. Weld 4013 toises high) 9987; whilst at the level of the ocean the extinction of light is 10000. (See my Table of the Geography of Plants, 1806.)

sates the effect of the height of the spot, and the thinness of the air, on the table-lands. The elevated strata of the atmosphere, when they envelop the ridges of mountains, experience rapid changes in their transparency.

The night of the 11th of November was cool and extremely beautiful*. Toward the morning, from half after two, the most extraordinary luminous meteors were seen toward the east. Mr. Bonpland, who had risen to enjoy the freshness of the air in the gallery, perceived them first. Thousands of bolides and falling stars succeeded each other during four hours. Their direction was very regularly from north to south. They filled a space in the sky extending from the true east 30° toward the north and south. In an amplitude of 60° the meteors were seen to rise above the horizon at E. N. E. and at E., describe arcs more or less extended, and fall toward the south, after having followed the direction of the meridian †. Some of them attained a height of 40°, and all exceeded 25° or 30°. There was very little wind in the low regions of the atmosphere,

* Cent. Therm. at 11 at night, 21·8°. Hygr. 82°. No twinkling of the stars above 10° of elevation.

† This uniform direction struck also several inhabitants of Nueva Barcelona, who mentioned it to us at our return from the Oroonoko, without our having spoken to them of the observations at Cumana.

and this blew from the east. No trace of clouds was to be seen. Mr. Bonpland relates, that, from the beginning of the phenomenon, there was not a space in the firmament equal in extent to three diameters of the moon, that was not filled at every instant with bolides and falling stars. The first were fewer in number, but as they were seen of different sizes, it was impossible to fix the limit between these two classes of phenomena. All these meteors left luminous traces from five to ten degrees in length, as often happens in the equinoctial regions*. The phosphorescence of these traces, or luminous bands, lasted seven or eight seconds. Many of the falling stars had a very distinct nucleus, as large as the disk of Jupiter, from which darted sparks of vivid light. The bolides seemed to burst as by explosion; but the largest, those from 1° to 1° 15′ in diameter, disappeared without scintillation, leaving behind them phosphorescent bands *(trabes)* exceeding in breadth fifteen or twenty minutes. The light of these meteors was white, and not reddish, which must be attributed, no doubt, to the absence of vapours, and the extreme transparency of the air. For the same reason, under the tropics, the stars of the first magnitude have at their rising a light evidently whiter than in Europe.

* See vol. i, p. 75.

Almost all the inhabitants of Cumana were witnesses of this phenomenon, because they leave their houses before four o'clock, to attend the first morning mass. They did not behold these bolides with indifference; the oldest among them remembered, that the great earthquakes of 1766 were preceded* by similar phenomena. The Guaiqueries in the Indian suburb came out and asserted, "that the firework had begun at one o'clock; and that as they returned from fishing in the Gulf, they had already perceived very small falling stars toward the east." They affirmed at the same time, that igneous meteors were extremely rare on those coasts after two in the morning.

The phenomenon ceased by degrees after four o'clock, and the bolides and falling stars became less frequent; but we still distinguished some toward the north east by their whitish light, and the rapidity of their movement, a quarter of an hour after sunrise. This circumstance will appear less extraordinary, when I bring to the reader's recollection, that in full daylight, in 1788, the interior of the houses in the town of Popayan were brightly illuminated by an aërolite of immense magnitude. It passed over the town, when the sun was shining clearly, about one o'clock. Mr. Bonpland and myself,

* See vol. ii, p. 216.

during our second residence at Cumana, after having observed, on the 26th of September, 1800, the immersion of the first satellite of Jupiter*, succeeded in seeing the planet distinctly with the naked eye, eighteen minutes after the disk of the sun had appeared in the horizon. There was a very slight vapour in the east, but Jupiter appeared on an azure sky. These facts prove the extreme purity and transparency of the atmosphere under the torrid zone. The mass of diffused light is so much less, as the vapours are more perfectly dissolved. The same cause, that weakens the diffusion of the solar light, diminishes the extinction of that which emanates either from a *bolis*, Jupiter, or the moon seen on the second day after her conjunction.

The day of the 12th of November was extremely hot, and the hygrometer indicated a very considerable dryness for those climates †. The reddish vapour clouded the horizon anew, and rose to the height of 14°. This was the last time it appeared this year; and I must

* I observed it at 5h 10′ 8″ mean time: long. of Cumana, deduced from the tables of Delambre, 4^h 25′ 57″ (Ast. Ob., Vol. i, p. 80).

† At nine in the morning, cent. therm. 26·2°; hygr. 66·4°. At one, therm. 29°; hygr. 81°. The scale of Saussure's hygr. is always meant, when the contrary is not expressly mentioned.

here observe, that it is no less rare under the fine sky of Cumana, than it is common at Acapulco, on the western coast of Mexico.

The researches of Mr. Chladni having singularly fixed the attention of the scientific world upon the bolides and falling stars at my departure from Europe, we did not neglect, during the course of our journey from Caraccas to the Rio Negro, to inquire every where, whether the meteors of the 12th of November had been perceived. In a savage country, where the greater number of the inhabitants sleep out in the air, so extraordinary a phenomenon could not fail to be remarked, except when concealed by clouds from the eye of observation. The Capuchin missionary at San Fernando de Apura*, a village situate amid the savannahs of the province of Varinas; the Franciscan monks stationed near the cataracts of the Oroonoko and at Maroa†, on the banks of the Rio Negro; had seen numberless falling stars and bolides illumine the vault of Heaven. Maroa is south-west of Cumana, at one hundred and seventy four leagues distance. All these observers compared the phenomenon to a beautiful firework, which had lasted from three till six in the morning. Some of the monks had marked the day upon their ritual; others had

* Lat. 7° 53′ 12″; long. 70° 20′.

† Lat. 2° 42′ 0″; long. 70° 21′.

noted it by the nearest festivals of the Church. Unfortunately none of them could recollect the direction of the meteors, or their apparent height. From the position of the mountains and thick forests, which surround the Missions of the Cataracts and the little village of Maroa, I presume that the bolides were still visible at 20° above the horizon. On my arrival at the southern extremity of Spanish Guiana, at the little fort of San Carlos, I found some Portugueze, who had gone up the Rio Negro from the Mission of St. Joseph of the Marivitains; who assured me, that in that part of Brazil the phenomenon had been perceived, at least as far as San Gabriel das Cachoeiras, consequently as far as the equator itself*.

I was powerfully struck at the immense height, which these bolides must have attained, to have been visible at the same time at Cumana, and on the frontiers of Brazil, in a line of two hundred and thirty leagues in length. But what was my astonishment, when, at my return to Europe, I learnt, that the same phenomenon had been perceived on an ex-

* A little to the north-west of San Antonio de Castanheiro. I did not find any persons, who had observed this meteor, at Santa Fe de Bogota, at Popayan, or in the southern hemisphere at Quito and Peru. Perhaps the state of the atmosphere, so changeable in these western regions, alone prevented any observation.

tent of the globe of 64° of latitude, and 91° of longitude; at the equator, in South America, at Labrador, and in Germany! I found accidentally during my passage from Philadelphia to Bourdeaux (in the Memoirs of the Pennsylvanian Society) the corresponding observation of Mr. Ellicot (lat. 30° 42′); and upon my return from Naples to Berlin, I read the account of the Moravian Missionaries among the Eskimoes, in the *Bibliothek* of Gottingen. Several philosophers* had already discussed at this period the coincidence of the observations in the North with those at Cumana, which Mr. Bonpland and I had published in 1800.

The following is a succinct enumeration of facts: 1st. the fiery meteors were seen in the east, and the east-north-east, to 40° of elevation, from 2^h to 6^h at Cumana (lat. 10° 27′ 52″, long. 66° 30′); at Porto Cabello (lat. 10° 6′ 52″, long. 67° 5′); and on the frontiers of Brazil, near the equator, in the longitude of 70° west of the meridian of Paris. 2nd. In French Guiana (lat. 4° 56′, long. 54° 35′), "the northern part of the sky was seen all on fire. Innumerable falling stars traversed the heavens during an hour and a half, and diffused so vivid a light,

* Messrs de Hardenberg, Ritter, and Bœckmann, in Gilbert's Annals, vol. vi, p. 191; vol. xiii, p. 255; vol. xiv, p. 116; vol. xv, p. 107. (Voigt., *Mag. der Naturkunde*, Tom. ix, p. 468.

that those meteors might be compared to the blazing sheaves shot out from a firework." The knowledge of this fact rests upon highly respectable testimony, that of the Count of Marbois, at that time transported to Cayenne, a victim to his love of justice and of rational, constitutional liberty. 3d. Mr. Ellicot, astronomer to the United States, having terminated his trigonometric operations for the rectification of the limits on the Ohio, being on the 12th of November in the Gulf of Florida, in the latitude of 25°, and longitude 81° 50′*, saw in all parts of the sky, "as many meteors as stars, moving in all directions: some appeared to fall perpendicularly; and it was expected every minute that they would drop into the vessel." The same phenomenon was perceived upon the American continent as far as the latitude of 30° 42′. 4th. In Labrador, at Nain (lat. 56° 55′) and Hoffenthal (lat. 58° 4′); in Greenland, at Lichtenau (lat. 61° 5′) and at New Herrenhut (lat. 64° 14′, long. 52° 20′); the Eskimoes were frightened at the enormous quantity of bolides, that fell during twilight toward all points of the firmament, and "some of which were a foot broad." 5th. In Germany, Mr. Zeissing, Vicar of Itterstadt, near Weimar (lat. 50° 59′, long. 9° 1′ east), perceived, on the

* Phil. Trans. of the American Soc. 1804, vol. vi, p. 29.

12th of November, between the hours of six and seven in the morning, when it was half after two at Cumana, some falling stars which shed a very white light. "Soon after, toward the south and south-west luminous rays appeared from four to six feet long; they were reddish, and resembled the luminous track of a sky-rocket. During the morning twilight between the hours of seven and eight, the south-west part of the sky was seen from time to time strongly illuminated by white lightning, which ran in serpentine lines along the horizon. At night the cold increased, and the barometer had risen." It is very probable, that the meteor might have been observed more to the east, in Poland and in Russia*. If Mr. Ritter had not taken a particular account of them from the Vicar of Itterstadt's papers, we should have supposed, that the bolides had not been visible beyond the limits of the New Continent.

The distance from Weimar to the Rio Negro is 1800 sea leagues; and from Rio Negro to Herrenhut in Greenland, 1300 leagues. Admit-

* At Paris and London the sky was cloudy. At Carlsruh Mr. Backmann saw before dawn lightning at the same time in the north-west and south-east. On the 13th of November a particular glare of light was seen at the same place in the south-east. (On the bolides seen at Hof, see *Helfrecht, Ficht.*, vol. ii, p. 205.)

ting that the same fiery meteors were seen at points so distant from each other, we must also admit, that their height was at least 411 leagues. Near Weimar, the appearance like sky-rockets was seen in the south, and south-east; at Cumana, in the east, and east-north-east. We may therefore conclude, that numberless aërolites must have fallen into the sea, between Africa and South America, to the west of the Cape-Verd Islands. But since the direction of the bolides was not the same at Labrador and at Cumana, why were they not perceived in the latter place towards the north, as at Cayenne? We can scarcely be too cautious on a subject, on which good observations made in very distant places are still wanting. I am rather inclined to think, that the Chayma Indians of Cumana did not see the same bolides, as the Portugueze in Brazil and the missionaries in Labrador; but at the same time it cannot be doubted, and this fact appears to me very remarkable, that in the New World, between the meridians of 46° and 82°, between the equator and 64° north, at the same hour, an immense number of bolides and falling stars were perceived; and that those meteors had every where the same brilliancy, throughout a space of 921,000 square leagues.

The scientific men *, who have lately made

* Mr. Benzenberg and Mr. Brandes.

such laborious researches on falling stars and their parallaxes, considered them as meteors belonging to the farthest limits of our atmosphere, between the region of the Aurora Borealis and that of the lightest clouds *. Some have been seen, which had not more than 14,000 toises, or about five leagues, of elevation. The highest do not appear to exceed thirty leagues. They have often more than a hundred feet diameter; and their swiftness is such, that they dart in a few seconds over a space of two leagues. Some of these have been measured, the direction of which was almost perpendicularly upward, or forming an angle of 50° with the vertical line. This extremely remarkable circumstance has led to the conclusion, that falling stars are not aërolites, which, after having hovered a long time in space, take fire on entering accidentally into our atmosphere, and fall toward the Earth †.

Whatever may be the origin of these luminous meteors, it is difficult to conceive an instantaneous inflammation taking place in a

* According to the observations made on the ridge of the Andes, at 2700 toises of elevation, on the *moutons* or little white and fleecy clouds, it appeared to me, that their elevation is sometimes not less than 6000 toises above the level of the coast.

† Mr. Chladni, who at first looked upon falling stars as aërolites, has lately abandoned this idea.

region, where there is less air than in the *vacuum* of our airpumps; and where (at 25,000 toises high) the mercury in the barometer would not rise to 0·012 of a line. We have ascertained the uniform mixture of atmospheric air to 0·003 nearly, only to an elevation of 3000 toises; consequently not beyond the last stratum of fleecy clouds. It might be admitted, that, in the first revolutions of the globe, gaseous substances, which yet remain unknown to us, may have risen toward that region, through which the falling stars pass: but accurate experiments, made upon mixtures of gasses which have not the same specific gravity, prove, that we cannot admit a superior stratum of the atmosphere entirely different from the inferior strata. Gaseous substances mix and penetrate each other with the least motion; and a uniformity of their mixture would have taken place in the lapse of ages *, unless we suppose in them the effects of a repulsive action unexampled in those substances which we can subject to our observations. Farther, if we admit the existence of particular aërial fluids in the inaccessible regions of luminous meteors, falling stars, bolides, and the Aurora Borealis; how

* See my experiments on a mixture of hydrogen and oxygen, or on an atmospheric air with base of hydrogen, in a paper on refractions inserted in my Astron. Obs. Vol. i, p. 117—120.

can we conceive why the whole stratum of those fluids does not at once take fire, but that the gaseous emanations, like the clouds, occupy only limited spaces? How can we suppose an electrical explosion without some vapours collected together, capable of containing unequal charges of electricity, in air, the mean temperature of which is perhaps 25° below the freezing point of the centigrade thermometer, and the rarefaction of which is so considerable, that the compression of the electrical shock could scarcely disengage any heat*? These difficulties would in great part be removed, if the direction of the motion of falling stars allowed us to consider them as bodies with a solid nucleus, as *cosmic* phenomena (belonging to space beyond the limits of our atmosphere), and not as *telluric* phenomena (belonging to our planet only).

Supposing that the meteors of Cumana were only at the usual height, at which falling stars in general move, the same meteors were seen above the horizon in places more than 310 leagues distant from each other †. Now what

* See an explanation of the heat produced by the electrical shock given by Mr. Gay-Lussac, in the year 1805, in a Paper which I published jointly with him in the *Journal de Phys.* vol. lx.

† It was this circumstance, that induced Lambert to propose the observation of falling stars for the determination of

an extraordinary disposition to *incandescence* must have reigned on the 12th November, in the higher regions of the atmosphere, to have furnished during four hours myriads of bolides and falling stars visible at the equator, in Greenland, and in Germany!

Mr. Benzenberg judiciously observes, that the same cause, which renders the phenomenon more frequent, has also an influence on the largeness of the meteors, and the intensity of their light. In Europe, the nights when there are the greatest number of falling stars are those, in which very bright ones are mixed with very small ones. The *periodicalness* of the phenomenon augments the interest which it excites. There are months, in which Mr. Brandes has reckoned in our temperate zone only sixty or eighty falling stars in one night; and in other months their number has risen to two thousand. Whenever one is observed, which has the diameter of Sirius or of Jupiter, we are sure of seeing so brilliant a meteor succeeded by a great number of smaller meteors. If the falling stars be very frequent during one night, it is very probable, that this frequency will continue during several weeks. It would seem, that in the higher regions of the atmosphere,

terrestrial longitudes. He considered them as celestial signals seen at great distances.

near that extreme limit where the centrifugal force is balanced by gravity, there exists at regular periods a particular disposition for the production of bolides, falling stars, and the Aurora Borealis *. Does the periodicalness of this great phenomenon depend upon the state of the atmosphere? or upon something which this atmosphere receives from without, while the Earth advances in the ecliptic? Of all this we are still as ignorant as men were in the days of Anaxagoras.

With respect to the falling stars themselves, it appears to me from my own experience, that they are more frequent in the equinoctial regions than in the temperate zone; more frequent over the continents, and near certain coasts, than in the middle of the ocean. Do the radiation of the surface of the globe, and the electric charge of the lower regions of the atmosphere, which varies according to the nature of the soil, and the positions of the continents and seas, exert their influence as far as those heights, where eternal winter reigns? The

* Ritter, on the periods of nine or ten years (1788, 1798, 1807,) in Gilbert's Annals, Vol. xv, p. 212; vol. xvi, p. 224. He makes a distinction, like several other natural philosophers, between the bolides mingled with falling stars and those luminous meteors, which, enveloped in vapours and smoke, explode with great noise, and let fall (mostly in the day-time) aërolites. These latter certainly do not belong to our atmosphere.

total absence even of the smallest clouds, at certain seasons, or above some barren plains destitute of vegetation, seem to prove, that this influence can be felt at least as far as five or six thousand toises high. A phenomenon analogous to that of the 12th of November was observed thirty years before, on the table-land of the Andes, in a country studded with volcanoes. At the city of Quito there was seen in one part of the sky, above the volcano of Cayambo, so great a number of falling stars, that the mountain was thought to be in flames. This singular sight lasted more than an hour. The people assembled in the plain of Exido, where a magnificent view presents itself of the highest summits of the Cordilleras. A procession was already on the point of setting out from the Convent of St. Francis, when it was perceived, that the blaze on the horizon was caused by fiery meteors, which ran along the skies in all directions, at the altitude of twelve or thirteen degrees.

CHAPTER XI.

Passage from Cumana to La Guayra.—Morro of New Barcelona.—Cape Codera.—Road from La Guayra to Caraccas.

On the 16th of November, at eight in the evening, we were under sail to pass along the coast from Cumana to the port of La Guayra, by which the inhabitants of the province of Venezuela export the greater part of their produce. The passage is only sixty leagues, and often takes only thirty-six or forty hours. The little coasting vessels are favored at once by the wind, and by the currents, which run with more or less strength from east to west, along the coasts of Terra Firma, particularly from Cape Paria to that of Chichibacoa. The road by land from Cumana to New Barcelona, and thence to Caraccas, is nearly in the same state as before the discovery of America. The traveller must contend with the obstacles of a miry country, large scattered rocks, and the force of vegetation. He must sleep in the open air, pass the vallies of the Unare, the Tuy, and

the Capaya, and cross the torrents, which increase rapidly on account of the proximity of the mountains. To these obstacles must be added the dangers, that arise from the extreme insalubrity of the country, through which he journies. The very low lands, between the sea-shore and the chain of hills nearest the coast, are extremely unhealthy, from the Bay of Mochima as far as Coro. But the latter town, surrounded by an immense wood of thorny cactuses, owes it's great salubrity, like Cumana, to the barrenness of it's soil and the absence of rain.

The road by land is sometimes preferred to the passage by sea, in returning from Caraccas to Cumana, to avoid going against the current. The postman from Caraccas is nine days in performing this journey. We often saw persons, who had followed him, arrive at Cumana ill of nervous and miasmatic fevers. The tree, of which the bark * furnishes a salutary remedy for those fevers, grows in the same vallies, and upon the edge of the same forests, which send forth such dangerous exhalations. Mr. Bonpland recognized the cuspare among the vegetables of the Gulf of Santa-Fe, situate between the ports of Cumana and Barcelona. The sick-

* Cortex Angusturæ of our Dispensatories, the bark of the *bonplandia trifoliata*.

ly traveller reposes himself in a cottage, the inhabitants of which are ignorant of the febrifuge qualities of the trees, that shade the surrounding vallies.

Passing by sea from Cumana to La Guayra, we intended to take up our abode in the town of Caraccas, till the end of the rainy season; to direct our course thence across the great plains or Llanos to the Missions of the Oroonoko; to go up that immense river, to the south of the cataracts, as far as Rio Negro and the frontiers of Brazil; and thence to return to Cumana by the capital of Spanish Guyana, vulgarly called, on account of it's situation, *Angostura,* or the Strait. It was not possible for us to fix the time it would require, to accomplish a tour of seven hundred leagues, more than two thirds of which was to be made in boats. The only parts of the Oroonoko known on the coasts are those near it's mouth. No commercial intercourse is kept up with the Missions. All the country beyond the Llanos is unknown to the inhabitants of Cumana and Caraccas. Some think, that the plains of Calabozo, covered with turf, stretch eight hundred leagues to the south, communicating with the Steppes or Pampas of Buenos Ayres; others, recalling to mind the great mortality, that reigned among the troops of Iturriaga and Solano, during their expedition to the Oroonoko, consider the whole coun-

try, south of the Cataracts of Atures, as extremely pernicious to health. In a region where travelling is so uncommon, there seems to be a pleasure in exaggerating to strangers the difficulties arising from the climate, the animals, and the Indians. We were yet little accustomed to the means of discouragement employed by the planters, with a candor at once simple and affectionate; but we persisted in the project we had formed. We could rely upon the interest and solicitude of the governor of Cumana, Don Vicente Emparan, as well as on the recommendations of the Franciscan monks, who are the real masters of the shores of the Oroonoko.

Fortunately for us, one of those monks, Juan Gonzales, was at that time at Cumana. This young monk was only a lay brother, but he was enlightened, highly intelligent, and full of spirit and courage. He had the misfortune shortly after his arrival on the coast to displease his superiors, upon the election of a new Director of the Missions of Piritoo, which is a period of great agitation in the Convent of New Barcelona. The victorious party exercised so general a retaliation, that the lay brother could not escape. He was sent to Esmeralda, the last Mission of the Upper Oroonoko, famous for an innumerable quantity of noxious insects, with which the air is continually filled. Fray

Juan Gonzales was thoroughly acquainted with the forests, which extend from the cataracts toward the sources of the Oroonoko. Another revolution in the republican government of the monks had some years before again brought him back to the coast, where he enjoyed, and with a just claim, the esteem of his superiors. He confirmed us in our desire of examining the much disputed bifurcation of the Oroonoko. He gave us useful advice for the preservation of our health, in climates where he had himself suffered long from intermitting fevers. We had the satisfaction of finding Fray Juan Gonzales at New Barcelona, on our return from Rio Negro. Intending to go from the Havannah to Cadiz, he obligingly offered to take charge of part of our herbals, and our insects of the Oroonoko; but these collections were unfortunately lost with himself in the Ocean. This excellent young man, who was strongly attached to us, and whose courageous zeal might have rendered great services to the Missions of his order, perished in a tempest on the coast of Africa, in 1801.

The boat which conveyed us from Cumana to La Guayra* was one of those, which trade between the coasts and the West India islands.

* This passage costs one hundred and twenty piastres, if you take the whole boat.

They are thirty feet long, and not more than three feet high at the gunwale; they have no decks, and their lading is generally from two hundred, to two hundred and fifty quintals. Although the sea is extremely rough from Cape Codera as far as La Guayra, and although the boats have an enormous triangular sail, somewhat dangerous in those gusts which issue from the passes of the mountains, there is not an example during thirty years of one of these boats being lost in the passage from Cumana to the coast of Caraccas. The skill of the Guaiqueria pilots is so great, that shipwrecks are very rare, even in the frequent trips they make from Cumana to Guadaloupe, or the Danish islands, surrounded with breakers. These voyages of 120 or 150 leagues, in an open sea, out of sight of land, are performed in boats without decks, in the manner of the ancients, without any observations of the meridian altitude of the sun, without charts, and generally without a compass. The Indian pilot directs his way at night by the polar star, and in the day by the course of the Sun and the wind, which he believes to be little variable. I have seen Guaiqueries and pilots of the coast of the Zamboes, who could find the polestar by the direction of the pointers, α and β of the Great Bear, and they seemed to me to steer less from the view of the polestar itself, than from the line

drawn through these stars. It is surprising, that at the first sight of land, they can find the Island of Guadaloupe, Santa Cruz, or Porto Rico; but the compensation of the errors of their course is not always equally fortunate. The boats, if they fall to leeward in making land, beat up with great difficulty to the eastward, against the wind and the current. The pilots, in time of war, often pay dearly for their ignorance and their neglect of the quadrant; since the privateers cruize near those very capes, which the boats of Terra Firma, when they miss their course, are obliged to make in order to find out where they are.

We descended rapidly the little river Manzanares, the windings of which are marked by cocoa-trees, as the rivers of our climates are bordered by poplars and old willows. On the adjacent arid land, the thorny bushes, on which by day are seen nothing but bushes covered with dust, glitter during the night with thousands of luminous sparks. The number of phosphorescent insects augments in the stormy season. We are never weary of admiring in the equinoctial regions the effect of those reddish and movable fires, which, reflected by a limpid water, blend their images with those of the starry vault of Heaven.

We quitted the borders of Cumana, as if we had long been their inhabitants. This was the

first land we had touched under a zone, toward which my wishes had been turned from my earliest youth. There is something so great, so powerful, in the impression made by nature in the climate of the Indies, that after an abode of a few months we seemed to have lived there during a long succession of years. In Europe, the inhabitant of the north and of the plains feels an almost similar emotion, when he quits even after a short abode the shores of the Bay of Naples, the delicious country between Tivoli and the Lake of Nemi, or the wild and solemn scenery of the Higher Alps and the Pyrenees. Yet every where under the temperate zone, the effects of the physiognomy of the vegetables afford little contrast. The firs and the oaks, that crown the mountains of Sweden, have a certain family air with those, which vegetate in the fine climates of Greece and Italy. Between the tropics on the contrary, in the lower regions of both Indies, every thing in nature appears new and marvellous. In the open plains, and amid the gloom of forests, almost all the remembrances of Europe are effaced; for it is the vegetation that determines the character of a landscape, and acts upon our imagination by it's mass, the contrast of it's forms, and the glow of it's colours. In proportion as impressions are powerful and new, they weaken antecedent impressions, and their strength gives them the ap-

pearance of duration. I appeal to those, who, more sensible of the beauties of nature than of the charms of social life, have long resided in the torrid zone. How dear, how memorable during life, is the land where they first disembarked! A vague desire to revisit that spot roots itself in their minds to the most advanced age. Cumana and it's dusty soil are still more frequently present to my imagination, than all the wonders of the Cordilleras. Beneath the fine sky of the south, the light, and the magic of the aërial hues, embellish a land almost destitute of vegetation. The Sun does not merely enlighten, it colours the objects, and wraps them in a thin vapour, which, without changing the transparency of the air, renders it's tints more harmonious, softens the effects of the light, and diffuses over nature that calm, which is reflected in our souls. To explain this vivid impression, which the aspect of the scenery in the two Indias produces, even on coasts where there is little wood, it will be sufficient to recollect, that the beauty of the sky augments from Naples toward the equator, almost as much as from Provence toward the south of Italy.

We passed at high water the bar which the little river Manzanares has formed at it's mouth. The evening breeze gently swelled the waves of the Gulf of Cariaco. The moon

had not risen, but that part of the milky way, which extends from the feet of the Centaur toward the constellation of Sagittarius, seemed to pour a silvery light over the surface of the ocean. The white rock, crowned by the Castle of St. Antonio, appeared from time to time between the high tops of the cocoa trees, that border the shore. We soon recognized the coasts only by the scattered lights of the Guayqueria fishermen. In these moments we felt in all it's force the charm of that spot, and the regret of leaving it. Five months had passed since we disembarked on that shore, as on a newly discovered land, strangers to all that surrounded us, approaching with mistrust every bush, every humid and shadowy spot. That coast now disappeared to our eyes, leaving remembrances which seemed of a long date. The soil, the rocks, the plants, the inhabitants, all now were become familiar to us.

We sailed at first to the N. N. W., approaching the peninsula of Araya; we then ran thirty miles to the W. and to the W. S. W. As we advanced toward the shoal that surrounds Cape Arenas, and stretches as far as the petroleum springs of Maniquarez, we enjoyed one of those varied sights, which the great phosphorescence of the sea so often displays in those climates. Bands of porpoises seemed to take pleasure in following our bark. Fifteen or sixteen of these

animals swam at equal distances; when, in turning on their backs, they struck the surface of the water with their broad tails, they diffused a brilliant light, that seemed like flames issuing from the depth of the ocean. Each band, in ploughing the surface of the waters, left behind it a track of light, the more striking as the rest of the sea was not phosphorescent. As the motion of an oar, and the track of the bark, produced on that night but feeble sparks, it is natural to suppose, that the vivid phosphorescence caused by the porpoises was owing not only to the stroke of their tails, but also to the gelatinous matter, that envelopes their bodies, and is detached by the shock of the waves.

We found ourselves at midnight between some barren and rocky islands, which rise like bastions in the middle of the sea, and form the groupe of the Caraccas and Chimanas *. The Moon was above the horizon, and lighted up those cleft rocks, bare of vegetation, and of a fantastic aspect. The sea here forms a sort of bay, a slight scooping out of the land between Cumana and Cape Codera. The islets of Picua, Picuita, Caraccas, and Boracha, appear like fragments of the ancient coast, which

* There are three of the Caraccas islands and eight of the Chimanas.

stretches from Bordones in the same direction east and west. The Gulfs of Mochima and of Santa-Fe, which will no doubt one day become frequented ports, lie behind those little islands. The rents in the land, the fracture and dip of the strata, every thing here denotes the effects of a great revolution. It was perhaps the same, that tore asunder the chain of the primitive mountains, and separated the mica-schistus of Araya and the island of Margaretta from the gneiss of Cape Codera. Many of these islands are visible at Cumana, from the terraces of the houses, and display, according to the superposition of layers of air more or less heated, the most singular effects of suspension and *mirage**. The height of these rocks does not probably surpass one hundred and fifty toises; but at night, enlightened by the moon, they seem to be of a very considerable elevation.

It may appear extraordinary, to find Caraccas Islands so distant from the city of that name, opposite the coast of the Cumanagotoes; but the denomination of Caraccas† denoted at the beginning of the Conquest not a par-

* See note D at the end of this volume.

† Oviedo y Banos, *Hist. de Venezuela*, Lib. iii, cap. 9, p. 140. One of the smaller West India islands, Gaudaloupe, was anciently called Caracqueira. Pet. Martyr, *Ocean.*, Dec. iii, Lib. ix, p. 306.

ticular spot, but a tribe of Indians neighbours of the Tecs, the Taramaynas, and the Chagaragates. As we came very near this group of mountainous islands, they becalmed us; and at sunrise, small currents drifted us toward Boracha, the largest of them. The rocks rising almost perpendicularly, the shore is abrubt; and in a subsequent voyage I saw frigates at anchor almost touching the land. The temperature of the atmosphere sensibly augmented since we were sailing among the islands of this little archipelago. The rocks, heated during the day, give out at night by radiation a part of the heat absorbed. As the sun arose on the horizon, the rugged mountains projected their vast shadows on the surface of the ocean. The flamingoes began to fish wherever they found in a creek calcareous rocks bordered by a narrow beach. All these islands are now entirely uninhabited; but upon one of the Caraccas are found wild goats of a large size, brown, and extremely swift. Our Indian pilot assured us, that their flesh has an excellent flavour. Thirty years ago a family of whites settled on this island, and cultivated maize and cassava. The father alone survived his children. As his wealth had increased, he purchased two black slaves, and this was the cause of his misfortunes. By his slaves he was murdered. The goats be-

came wild, but the cultivated plants did not. Maize in America, like wheat in Europe, connected with man since his first migrations, appears to be preserved only by his care. We sometimes see these nourishing gramina disseminate themselves; but when left to nature, the birds prevent their reproduction by destroying the seeds. The two slaves of the isle of Caraccas long escaped punishment; it was difficult to ascertain a crime committed in so lonely a spot. One of these blacks is now the hangman at Cumana. He informed against his accomplice, and an executioner being wanted, he obtained pardon on condition, according to the barbarous custom of the country, of hanging all the prisoners on whom sentence of death had been pronounced long before. It seems difficult to believe, that there are men sufficiently ferocious, to preserve their lives at this price; and execute, with their own hands to day, those whom they informed against yesterday.

We quitted a spot that left such painful remembrances, and anchored for some hours in the road of New Barcelona, at the mouth of the river Neveri, of which the Indian (Cumanagoto) name is *Enipiricuar*. This river is full of crocodiles, which sometimes continue their excursions into the open sea, especially in calm weather. They are of the species com-

mon in the Oroonoko, which so much resembles the crocodile of Egypt, that they have long been confounded together. We may conceive that an animal, the body of which is surrounded with a kind of armour, must be nearly indifferent to the saltness of the water. Pigafetta * had already seen, as he relates in his journal recently published at Milan, crocodiles that inhabit alike the land and the sea. These facts must be interesting to geologists, since their attention has been fixed on the fresh-water formations, and the curious mixture of marine and fluviatile petrifactions, which are sometimes observed in certain very recent rocks.

The port of Barcelona, of which the name is scarcely to be found on our maps, has had a very active commerce ever since 1795. From it is exported great part of the produce of those vast steppes, which extend from the south side of the chain of the coast as far as the Oroonoko, and which abound in cattle of every kind, almost as much as the Pampas of Buenos Ayres. The commercial industry of these countries depends on the demand in the great and little West India islands for salted provision, oxen, mules, and horses. The coasts of Terra Firma being opposite to those of the Island of Cuba,

* Amoretti's translation, p. 154.

at a distance of fifteen or eighteen days' sail, the merchants of the Havannah prefer, especially in time of peace, drawing their provision from the port of Barcelona, to the risque of a long voyage in another hemisphere to the mouth of the Rio de la Plata. Of a black population amounting to 1,300,000, which the archipelago of the West India islands now contains, Cuba alone has more than 230,000 slaves* who are fed with vegetables, salt provision, and dried fish. Every vessel, that trades in salt meat, or *tasajo*, from Terra Firma, carries twenty or thirty thousand arobas, the sale price of which is more than forty-five thousand piastres. The situation of Barcelona is singularly advantageous for the trade in cattle. The animals have only three days' journey from the Llanos to the port, while it requires eight or nine days to reach Cumana, on account of the chain of mountains of the Brigantine and the Impossible. According to the best information I could obtain, eight thousand mules were embarked at Barcelona, six thousand at Porto-

* The debates in the Cortes of Cadiz on the abolition of the slave trade led the *Consulado* of the Havannah, to make an accurate inquiry, in 1811, into the population of the island of Cuba. It was found to contain 600,000 souls, of whom 274,000 were whites, 114,000 free men of colour, and 212,000 Negro slaves. The estimation published in my work on Mexico, vol. ii, p. 7, was therefore much too small.

Cabello, and three thousand at Carupano, in 1799 and 1800, for the Spanish, English, and French islands. I am ignorant of the precise exportation of Burburata, Coro, and the mouths of the Guarapiche and the Oroonoko; but I believe, notwithstanding the causes that have diminished the quantity of cattle in the Llanos of Cumana, Barcelona, and Caraccas, those immense steppes did not furnish less at that period than thirty thousand mules a year for the West India trade. Estimating each mule at twenty-five piastres (the cost price) we find that this branch of trade alone produces nearly 3,700,000 francs, without reckoning the profits on the freight of the vessels. Mr. de Pons *, in general very exact in his statistical computations, estimates them at a much smaller number. But as he could not himself visit the Llanos, his place of agent to the French government obliging him to reside constantly at the town of Caraccas, the proprietors of the *Hatos* perhaps communicated to him too low estimations. I shall collect farther on, in a particular chapter, whatever relates to the trade and agricultural industry of these countries.

Having disembarked on the right bank of the Neveri, we ascended to a little fort, *El*

* *Voyage à la Terra-Ferme*, vol. ii, p. 386.

Morro de Barcelona, built at sixty or seventy toises of elevation above the level of the sea. It is a calcareous rock lately fortified; but is commanded on the south by a hill far more lofty; and engineers assert, that it would not be difficult for an enemy, after having landed between the mouth of the river and the Morro, to turn the latter, and erect batteries on the surrounding heights. We remained five hours in the fort, the guard of which is confided to the provincial militia. We waited in vain for intelligence concerning the English privateers stationed along the coast. Two of our fellow-travellers, brothers of the Marquis del Toro of Caraccas, came from Spain, where they had served in the King's guards. They were men of highly cultivated minds, who, in company with the brigadier de Caxigal, and Count Tovar, were returning, after a long absence, to their native country. They had more reason than we to fear being made prisoners, and carried to Jamaica. I had no passport from the admiralty, but secure in the protection, which the English government grants to those, who travel for the progress of science, I had written on my arrival at Cumana to the governor of the island of Trinidad, to explain to him the purpose of my researches. The answer I received by way of the Gulf of Paria was entirely to my satisfaction.

The view from the height of the Morro is not without beauty. The rocky island of Boracha lies on the east, the lofty promontory of Unare on the west, and below is the mouth of the river Nereri, and the arid shores, on which the crocodiles come to sleep in the sun. Notwithstanding the extreme heat of the air, for the thermometer, exposed to the reflection of the white calcareous rock, rose to 38°, we walked all over the hill. A fortunate chance led us to observe a very curious geological phenomenon, which we again found in the Cordilleras of Mexico *. The limestone of Barcelona has a dull, even, or conchoidal fracture, with very flat cavities. It is divided into very thin strata, and displays less analogy with the limestone of Cumanacoa, than with that of Caripe, forming the cavern of Guacharo. It is traversed by banks of *schistose jasper* †, black, with a conchoidal fracture, breaking into fragments of a parallelopipedal figure. This fossile does not exhibit those little streaks of quartz, so common in the Lydian stone. It is found decomposed at it's surface into a yellowish gray crust, and does not act upon the magnet. It's edges, a little translucid, make it resemble the hornstein, which is so common in secondary limestones ‡. It

* *Essai Politique sur la nouvelle Espagne*, Tom. ii, p. 535.

† *Kieselschiefer* of Werner.

‡ In Switzerland, the hornstein passing into common

is remarkable, that we find the schistose jasper which in Europe characterizes the transition rocks *, in a limestone that has a great analogy with that of Jura. In the study of formations, which is the great end of geognosy, the knowledge acquired in the two worlds should furnish reciprocal aid to each other. It appears, that these black strata are found also in the calcareous mountains of the Island of Boracha†. Another jasper, that which is known by the name of the Egyptian pebble, was found by Mr. Bonpland near the Indian village of Curacatiche‡, fifteen leagues south of the Morro of Barcelona, when, returning from the Oroonoko, we crossed the Llanos, and approached the mountains on the coast. This stone presented yellowish concentric lines and bands, on a reddish brown ground. It appeared to me, that the round pieces of Egyptian jasper belonged also to the Barcelona limestone. Yet, according to Mr. Cordier, the fine pebbles of Suez are owing to a breccia formation, or siliceous agglomerate.

jasper is found in kidney-stones and in layers both in the Alpine and Jura limestone, especially in the former.

* The transition limestone and schistus.

† We saw some of it as ballast, in a fishing boat at Punta Araya. It's fragments might have been mistaken for basaltes.

‡ Or Curacaguitiche.

At the instant we set sail, on the 19th of November at noon, I took some altitudes of the Moon, to determine the longitude of the Morro. The difference of meridian between Cumana and the town of Barcelona, where I made a great number of astronomical observations in 1800, is 0° 34′ 48″. I have elsewhere discussed this difference, upon which there were many doubts at that period*. I found the dip † of the needle 42·20°: the intensity of the forces was equal to 224 oscillations.

From the Morro of Barcelona, as far as Cape Codera, the land becomes low, as it recedes toward the south; and it's soundings run out into the sea to the distance of three miles. Beyond this we find the bottom at forty-five or fifty fathoms. The temperature of the sea at it's surface was 25·9°: but when we were passing through the narrow channel, that separates the

* See the Introduction to my Ast. Obs., vol. i, p. xxxix. Mr. Espinosa has fixed on 34′. The pilots, who navigate these coasts, reckon from Cumana to Barcelona twelve leagues; from Barcelona to the Piritoo Islands six leagues; from these islands to Cape Unare six leagues; from Cape Unare to Cape Codera eighteen leagues. By Berthoud's timekeeper I found the western point of the greatest of the Piritoo Islands 14′ 32″, and Cape Codera 1° 24′ 4″, west of the meridian of Nueva Barcelona.

† This result properly belongs to the first of August, 1800, and to the town of Nueva Barcelona (lat. 10° 6′ 52″), where I was able to make the observation with greater care.

two Piritoo Islands, in three fathoms water, the thermometer was only 24·5°. The difference was constant. It would perhaps be greater, if the current, which runs with rapidity toward the west, stirred up deeper waters; and if, in a pass of such small width, the land did not contribute to raise the temperature of the sea. The Piritoo Isles resemble those shoals which become visible when the tide falls. They do not rise more than eight or nine inches above the mean height of the sea. Their surface is all smooth, and covered with grass. We might have thought we beheld one of our northern meadows. The disk of the setting sun appeared like a globe of fire suspended over the savannah; and it's last rays, as they swept the earth, illumined the extremities of the grass, strongly agitated by the evening breeze. In the low and humid places of the equinoctial zone, even when the gramineous plants and reeds present the aspect of a meadow, or of turf, a rich decoration of the picture is usually wanting; I mean that variety of wild flowers, which, scarcely rising above the grass, seem to lie upon a smooth bed of verdure. Between the tropics, the strength and luxury of vegetation give such a developement to plants, that the smallest of the dicotyledonous family become shrubs. It would seem as if the liliaceous plants mingled with the gramina assumed

the place of the flowers of our meadows. Their form is indeed striking; they dazzle by the variety and splendour of their colours; but, too high above the soil, they disturb that harmonious relation, which exists among the plants that compose our meadows and our turf. Nature, in her beneficence, has given the landscape under every zone it's peculiar type of beauty.

We ought not to wonder, that fertile islands, so near the continent, are not now inhabited. It was only at the first period of the discovery, and when the Caribbees, Chaymas, and Cumanagotoes were still masters of the coast, that the Spaniards formed settlements at Cubagua and Margaretta. When the natives were subdued, or driven to the south, toward the savannahs, settlements on the continent were preferred, where there was a choice of land, and of Indians, who might be treated like beasts of burden. If the little islands of Tortuga, Blanquilla, and Orchilla, had been placed amid the group of the Antilles, they would not have remained without any trace of cultivation.

Vessels that draw a great deal of water pass between the main land and the most southern of the Piritoo Islands. Being very low, their northern point is dreaded by the pilots, who come near the coast in those latitudes. When we found ourselves to the westward of the

Morro of Barcelona, and the mouth of the river Unare, the sea, till then calm, became agitated and rough in proportion as we approached Cape Codera. The influence of that vast promontory is felt from afar, in that part of the Caribbean Sea. The length of the passage from Cumana to La Guayra depends on the degree of facility, with which Cape Codera can be doubled. Beyond this cape the sea constantly runs so high, that we can scarcely believe we are near a coast, where (from the point of Paria as far as Cape St. Roman) a gale of wind is never known. The impulse of the waves was strongly felt in our boat. My fellow travellers suffered much. I slept calmly, having the good fortune, uncommon enough, of not being subject to sea-sickness. It blew fresh during the night. On the 20th of November at sunrise we were sufficiently advanced, to have the expectation of doubling the cape in a few hours. We hoped to arrive the same day at La Guayra; but our Indian pilot was assailed by fresh fears of the privateers stationed near that port. He thought it would be prudent therefore to make for the land, and anchor in the little harbour of Higuerota, which we had already passed, and await the shelter of night to proceed on our voyage. When it is proposed to persons suffering from sea-sickness to disembark, it is easy to guess the resolution they will

take. Remonstrances were useless; and, compelled to yield, we were on the 20th of November at nine in the morning at anchor in the Bay of Higuerota, west of the mouth of the Rio Capaya.

We found neither village nor farm, but two or three huts, inhabited by mestizo fishermen. Their livid tint, and the extreme thinness of their children, informed us, that this spot is one of the most unhealthy and feverish of the whole coast. The sea had so little depth in these parts, that even with the smallest barks you cannot land without wading in the water. The forests come down nearly to the beach, which is covered with a thicket of mangroves, avicennias, manchineel trees, and that new species of suriana, which the natives call *romero de la mar* *. It is to this thicket, and particularly to the exhalations of the mangroves, that the extreme insalubrity of the air is attributed here, as every where else in both Indies. On disembarking, and when we were yet fifteen or twenty toises distant, we perceived a faint and sickly smell, which reminded me of that diffused through the galleries of deserted mines, where the lights begin to go out, and the timber is all covered with flocculent byssus. The temperature of the air rose to 34°, heated by the

* Suriana maritima.

reverberation from the white sands, which form a border between the mangroves and the great trees of the forest. As the shore descends with a gentle slope, the small tides are sufficient alternately to cover and uncover the roots, and part of the trunk of the mangroves. It is, no doubt, while the Sun heats the humid wood, and causes the fermentation as it were of the ground, the remains of dead leaves, and the molluscæ envelopped in the drift of floating sea-weed, that those deleterious gasses are formed, which escape our researches. We saw the sea-water, along the whole coast, acquire a yellowish brown tint, wherever it comes into contact with the mangrove trees.

Struck with this phenomenon, I gathered at Higuerota a considerable quantity of branches and roots, in order to make some experiments on the infusion of the mangrove, upon my arrival at Caraccas. The infusion in warm water had a brown colour, and an astringent taste. It contained a mixture of extractive matter, and tannin. The rhizophora, the mistleto, the cornel-tree, all the plants, which belong to the natural families of the lorantheous and the caprifoliaceous plants, have the same properties. The infusion of mangrove wood, kept in contact with atmospheric air under a glass jar for twelve days, did not sensibly affect it's purity. A little blackish flocculent sediment was formed, but

it was attended by no sensible absorption of oxygen. The wood and roots of the mangrove placed under water were exposed to the rays of the Sun. I tried to imitate the daily operations of nature on the coasts at the rise of the tide. Bubbles of air were disengaged, and at the end of ten days formed a volume of thirty-three cubic inches. They were a mixture of azot gas and carbonic acid. Nitrous gas scarcely indicated the presence of oxygen*. Lastly, I set the wood and the roots of the mangrove thoroughly wetted, to act on a given volume of atmospheric air in a phial with a ground glass stopple. The whole of the oxygen disappeared; and, far from being replaced by carbonic acid, limewater indicated only 0·02. There was even a diminution of the volume of air, more than corresponded with the oxygen absorbed. These slight experiments led me to think, that it is the moistened bark and wood, that act upon the atmosphere in the forests of mangrove-trees, and not the water strongly tinged with yellow, which formed a distinct band along the coasts. In pursuing the different stages of decomposition of the ligneous matter, I observed no appearance of a disengagement of sulphuretted

* In a hundred parts there were eighty-four of nitrogen, fifteen of carbonic acid gas that the water had not absorbed, and one of oxygen.

hydrogen, to which many travellers attribute the smell perceived amid mangroves. The decomposition of the earthy and alkaline sulphats, and their transition to the state of sulphurets, no doubt may favour this disengagement in many littoral and marine plants; for instance, in the fuci: but I am rather inclined to think, that the rhizophora, the avicennia, and the conocarpus, augment the insalubrity of the air by the animal matter, which they contain jointly with tannin. These shrubs belong to the three natural families of the lorantheæ, the combretaceæ *, and the pyrenaceæ, in which the astringent principle abounds; and I have already observed, that this principle accompanies gelatin, even in the bark of beech, alder, and nut-trees †.

Besides, a thick wood covering marshy grounds would diffuse noxious exhalations in the atmosphere, were it composed of trees which in themselves have no deleterious properties. Wherever mangroves grow on the seashore, the beach is covered with an infinite number of molluscæ and insects. These animals love the shade, and a faint light; and they find themselves sheltered from the shock of the waves amid this scaffolding of thick and intertwining roots, which

* Rob. Brown, *Flor. Nov. Holl. Prod.*, vol. i, p. 351.
† Vauquelin, *Annal. du Mus.*, T. xv, p. 77.

rises like lattice-work above the surface of the waters. Shell-fish cling to this lattice; crabs nestle in the hollow trunks; and the sea-weeds, which the winds and tides drive toward the coasts, remain suspended on the recurved branches, that bend toward the earth. It is thus that maritime forests, accumulating a slimy mud between their roots, aggrandize the domain of the continent; but while they gain on the sea, they augment but little in breadth; for their progress itself becomes the cause of their destruction. The mangroves, and the other vegetables with which they live constantly in society *, perish as the ground dries, and they are no longer bathed with salt water. Their old trunks covered with shells, and half buried in the sand, denote, after the lapse of ages, the path they have followed in their migrations, and the limits of the land which they have wrested from the ocean.

The Bay of Higuerota is very favourably situate for examining Cape Codera, which presents itself in all it's extent seven miles distant. This promontory is more remarkable for it's size, than for it's elevation, which, according

* The following are the names of these plants found on the continent, and on the islands. Avicennia nitida, a. guyanensis Rich., conocarpus racemosa, rhizophora mangle, cocolloba uvigera, hippomane mancinella, echites biflora, suriania, strumpfia, the pinau palm-tree, &c.

to the angles of elevation * taken on the shore, appeared to be only two hundred toises. It is perpendicular on the north, the west, and the east. In these grand profiles the dip of the strata appears to be distinguishable. Judging from the fragments of rock found along the coast, and from the hills near Higuerota, Cape Codera is not composed of granite with a granular texture, but of a real gneiss with a foliated texture. It's laminæ are very broad, and sometimes sinuous †. They contain large nodules of reddish feldspar, and little quartz. The mica is found in superposed lamellæ, not isolated. The strata nearest the bay were in the direction of N. 60° E., and dipped 80° to the N. W. These relations of direction and of dip are the same at the great mountain of the Silla, near Caraccas, and to the east of Maniquarez in the isthmus of Araya. They seem to prove, that the primitive chain of that isthmus, after having been ruptured or swallowed up by the sea through a space of thirty-five leagues ‡, appears anew in Cape Codera, and continues toward the west as a chain of the coast.

I was assured, that in the interior of the land, south of Higuerota, limestone formations are

* The apparent angle is 1° 25′ 20″.

† *Dickflasriger gneiss.*

‡ Be tween the meridians of Maniquarez and Higuerota.

found. The gneiss did not act upon the magnetic needle: yet along the coast, which forms a cove toward Cape Codera, and which is covered with a fine forest, I saw magnetic sands mixed with spangles of mica, which are deposited by the sea. This phenomenon occurs again near the port of La Guayra. It perhaps denotes the existence of some strata of hornblende schistus covered by the waters, in which schistus the sand is disseminated. Cape Codera forms toward the north an immense spherical segment. A very low land stretches at it's foot, which is known to navigators by the name of the Points of Tutumo and of San Francisco.

My fellow travellers dreaded so much the rolling of our little vessel, in a rough and swelling sea, that they resolved to take the road by land, which leads from Higuerota to Caraccas. This passes through a wild and damp country, by the Montana of Capaya north of Caucagua, and the valley of Rio Guatira and Guarenas. I found with satisfaction that Mr. Bonpland preferred this road, which, notwithstanding the continual rains, and the overflowing of the rivers, procured him a rich collection of new plants*. For my part, I continued

* Bauhinia ferruginea, brownea racemosa Bred., inga hymenæifolia, i. curiepensis, which Mr. Wildenouw has called by mistake i. caripensis, &c.

alone with the Guaiqueria pilot the voyage by sea. It appeared to me hazardous, to lose sight of the instruments, which we were to make use of on the banks of the Oroonoko.

We set sail at the beginning of the night. The wind was unfavourable, and we doubled Cape Codera with difficulty. The surges were short, and often broke one upon another. A man must have felt the fatigue of an extremely hot day, to have slept in a little boat, that steered close to the wind. The sea ran the higher, on account of the wind being contrary to the current, till after midnight. The general motion of the waters between the tropics toward the west is felt strongly on the coast during two thirds only of the year. In the months of September, October and November, the current often flows toward the east* for fifteen or twenty days in succession. Vessels on their way from Guayra to Porto Cabello have been known to be unable to stem the current, that runs from west to east, although they had the wind astern. The cause of these anomalies is not yet discovered. The pilots think they are the effect of some gales of wind from the northwest in the Gulf of Mexico. Yet these gales are much more violent toward the spring † than in autumn. It is also remarkable, that the

* *Corriente por arriba.*

† *Nouv. Espagne*, Tom. i, p. 50.

current to the east precedes the change of the wind. It begins to be felt at first during a calm; and after some days, the wind itself follows the current, and becomes fixed in the west. While these phenomena last, the course of the small barometrical tides is in no degree interupted.

On the 21st of November at sunrise, we were to the west of Cape Codera, opposite Curuao. The Indian pilot was affrighted at seeing an English frigate to the north, at a mile distant. We were no doubt taken for one of those boats, which carry on a contraband trade with the West India islands, and which (for every thing becomes regularly established in time,) were furnished with *licences*, signed by the governor of Trinidad. We were not even hailed by the ship's boats, which appeared to approach us. From Cape Codera the coast is rocky, and very high, and presents scenes at once savage and picturesque. We were near enough the land to distinguish scattered huts surrounded by cocoa-trees and spots covered with vegetation, which studded the dark ground of the rocks. The mountains are every where perpendicular, and three or four thousand feet high; their sides cast broad and deep shadows upon the humid land, which extends to the sea, and glows with the freshest verdure. This shore produces in great part the fruits of the

hot regions, which are found in such great abundance in the markets of the Caraccas. The fields cultivated with sugarcanes and maize, between Camburi and Niguatar, stretch along narrow vallies, which resemble crevices or clefts in the rocks; and which, penetrated by the rays of the sun, then above the horizon, presented the most singular contrasts of light and shade.

The mountain of Niguatar and the Silla of Caraccas are the loftiest summits of this littoral chain. The first almost reaches the height of Canigou; it seems as if the Pyrennees or the Alps, stripped of their snows, had risen from the bosom of the waters; so much greater appears the mass of mountains, when viewed for the first time on the side of the sea. Near Caravalleda, the cultivated lands enlarge; we find hills with gentle declivities, and the vegetation rises to a great height. The sugarcane is here cultivated, and the monks of La Merci have a plantation of two hundred slaves. This spot was formerly extremely subject to fever; and it is said, that the salubrity of the air is increased, since trees have been planted round a small lake, the emanations of which were dreaded, and which is now less exposed to the ardour of the sun. To the west of Caravalleda, a wall of bare rocks comes forward again toward the sea, but it has little extent. After

having passed it, we discovered at once the pleasant situation of the village of Macuto; the black rocks of La Guayra, studded with batteries rising in tiers one over another; and in a misty distance Cabo Blanco, a long promontory with conical summits, and of dazzling whiteness. Cocoa-trees border the shore, and give it under that burning sky an appearance of fertility.

I landed in the port of La Guayra, and the same evening made preparations for transporting my instruments to Caraccas. The persons for whom I had recommendations advised me not to sleep in the town, where the yellow fever had only ceased a few weeks, but in a house on a little hill, above the village of Maiquetia, more exposed to fresh winds than La Guayra. I arrived at Caraccas the 21st of November, in the evening, four days sooner than my fellow travellers, who on their journey by land had suffered greatly from the showers, and the inundations of the torrents, between Capaya and Curiepe. In order to avoid repeating the same subjects, I shall here subjoin to the description of La Guayra, and the extraordinary road which leads from that port to the town of Caraccas, all the observations made by Mr. Bonpland and myself, in an excursion to Cabo Blanco* toward the end of January, 1800. Mr.

* From the 23d to the 27th of January.

Depons having visited these spots after me, and his instructive work having preceded mine, I shall abstain from describing objects minutely, which he has treated with sufficient precision*.

La Guayra is rather a roadstead than a port. The sea is constantly agitated, and the ships suffer at once by the action of the wind, the tideways, the bad anchorage, and the worms†. The lading is taken in with difficulty, and the heights of the swell prevents embarking mules here, as at New Barcelona and Porto Cabello. The free Mulattoes and Negroes, who carry the cacao on board the ships, are a class of men of very remarkable muscular strength. They go up to their middles through the water; and, what is well worthy of attention, they have nothing to fear from the sharks, which are so frequent in this harbour. This fact seems con-

* I must here observe, that the measures of heights, and the results of magnetical observations published by Mr. Depons, vol. iii, p. 66, 197, are founded on my approximate calculations made upon the spot, and copies of which I had given to several persons, who were interested in these investigations. It is to mistakes in these copies, no doubt, that must be attributed the indications of the *hydrometer* of Deluc; the dip of the needle confounded with the height of the Pole at Caraccas; the oscillations of a pendulum, the length of which is neither determined, nor the number of oscillations compared to those performed at another place in the same space of time.

† *La broma*, teredo navalis, Lin.

nected with what I have often observed between the tropics, relatively to other classes of animals that live in society, for instance, monkeys and crocodiles. In the Missions of the Oroonoko, and the river of Amazons, the Indians, who catch monkeys to sell them, know very well, that they can easily succeed in taming those, which inhabit certain islands; while monkeys of the same species, caught on the neighbouring continent, die of terror or rage when they find themselves in the power of man. The crocodiles of one pool in the Llanos are cowardly, and flee even in the water; while those of another attack with extreme intrepidity. It would be difficult to explain this difference of manners and habits, by the aspect of their respective localities. The sharks of the port of La Guayra seem to furnish an analogous example. They are dangerous and bloodthirsty at the island opposite the coast of Caraccas, at the Roques, at Bonayre, and at Curassao; while they forbear to attack persons swimming in the ports of La Guayra and Santa Martha. The people, who, in order to simplify the explanation of natural phenomena, have always recourse to the marvellous, affirm, that in both places a bishop gave his benediction to the sharks.

The situation of La Guayra is very singular, and can only be compared to that of Santa

Cruz in Teneriffe. The chain of mountains, that separates the port from the high valley of Caraccas, descends almost directly into the sea; and the houses of the town are backed by a wall of steep rocks. There scarcely remains one hundred or one hundred and forty toises breadth of flat ground between the wall and the ocean. The town has six or eight thousand inhabitants, and contains only two streets, running parallel to each other east and west. It is commanded by the battery of *Cerro colorado*; and it's fortifications along the seaside are well disposed, and kept in repair. The aspect of this place has something solitary and gloomy; we seemed not to be on a continent, covered with vast forests, but in a rocky island, destitute of mould and vegetation. With the exception of Cape Blanco and the cocoa-trees of Maiquetia, no view meets the eye but that of the horizon, the sea, and the azure vault of Heaven. The heat is stifling during the day, and most frequently during the night. The climate of La Guayra is justly considered as more ardent than that of Cumana, Porto Cabello, and Coro; because the sea breeze is less felt, and the air is heated by the radiant caloric, which the perpendicular rocks emit from the time the Sun sets. We should however judge amiss of the atmospheric constitution of this spot, and of all the neighbouring shore, if we

only compared the temperatures indicated by the degrees of the thermometer. A stagnant air ingulfed in a hollow of the mountains, in contact with a mass of barren rocks, acts differently on our organs from air equally hot in an open country. I am far from looking for the physical cause of this difference only in the modifications of the electrical charge of the air; I must however add, that a little to the east of La Guayra, on the side of Macuto, far from houses, and more than a hundred toises distant from the rocks of gneiss, I could scarcely obtain during several days a few feeble signs of positive electricity; while at the same hours of the afternoon at Cumana, and with the same electrometer of Volta, armed with a smoking match, I observed a separation of the balls of pith of elder from one to two lines. I shall notice farther on the regular variations which the electrical charge of the air undergoes every day in the torrid zone, and which indicate a striking relation between the changes of the temperature and the height of the Sun. The examination of the thermometric observations, made during nine months at La Guayra by a distinguished physician *,

* Don Joseph Herrera, correspondant of the Medical Society of Edinburgh. The observations (from the 2d of May 1799 to the 17th of January 1800) were made in the shade, far from the reflection of walls, with a thermometer

enabled me to compare the climate of this port, and that of Cumana, the Havannah, and Vera-Cruz. This comparison is the more interesting, as it furnishes an inexhaustible subject of conversation in the Spanish colonies, and among the mariners who frequent those latitudes. As nothing is more deceitful in this matter than the testimony of the senses, we can judge of the difference of climates only by numerical calculations.

The four places of which we have been speaking are considered as the hottest* on the shores of the New World. A comparison of them may serve to confirm, what we have several times observed, that it is generally the duration of a high temperature, and not the excess of heat, or it's absolute quantity, which occasions the sufferings of the inhabitants of the torrid zone.

The mean of the observations made at noon, from the 27th of June to the 16th of November, were, at La Guayra, 31·6° of the centigrade thermometer; at Cumana, 29·3°; at

which I compared with mine, and, by means of mine, with the thermometer of the observatory at Paris.

* We could add to this small number, Coro, Carthagena, Omoa, Campeachy, Guayaquil, and Acapulco. My comparisons are founded, for Cumana, on my own observations and those of Don Faustin Rubio; and for Vera Cruz and the Havannah, on the observations of Don Bernardo de Orta and Don Joacquin Ferrer.

Vera Cruz, 28·7°; at the Havannah, 29·5°. The daily difference at the same hour, scarcely exceeded 0·8° or 1·4°. During this period it rained but four times, and then only for seven or eight minutes. At this season, the yellow fever prevails; which usually disappears at La Guayra, as at Vera Cruz*, and the island of St. Vincent, when the temperature of the day descends below twenty three, or twenty four degrees. The mean temperature of the hottest month was, at La Guayra, nearly 29·3°; at Cumana, 29·1°; at Vera Cruz, 27·7°; at Cairo, according to Nouet, 29·9°; at Rome, 25°. From the 16th of November to the 19th of December, the mean temperature of noon, at La Guayra, was only 24·3°; at night, 21·6°. This is the time at which the sufferings from heat are the least; and yet I do not believe, that the thermometer ever falls (and it is lowest a little before sunrise) below 21°. It sometimes descends at Cumana to 21·2°; at Vera Cruz, to 16°; at the Havannah (always when the north wind blows), to 8° and even lower. The mean temperature of the coldest month† is, in these four places, 23·2°, 26·8°, 21·1°, 21·0°. At Cairo, it is 13·4°. The mean *of the whole year*, according to good

* *Nouv. Espagne*, vol. ii, p. 765.

† The mean of the hottest month at Paris is 19° or 20°, consequently 3 or 4 degrees less than the coldest month at La Guayra.

observations carefully calculated, is, at La Guayra, nearly 28·1°; at Cumana, 27·7°; at Vera Cruz, 25·4°; at the Havannah, 25·6°; at Rio Janeiro, 23·5°; at Santa Cruz in Teneriffe, in the latitude of 28° 28′, but backed, like La Guayra, by a wall of rocks, 21·9°; at Cairo, 22·4°; at Rome, 15·8°.

From the whole of these observations* it follows, that La Guayra is one of the hottest

* The following are the horary variations of the barometer in Paris lines, with the heights of the centigrade thermometer and of the whalebone hygrometer of Deluc, as I observed them from the 23d to the 25th of January, at the port of La Guayra.

Day	Hour	Barom.	Therm.	Hygrom.
23d	11 even.	337·2°	23·5°	51·0° star light, fine.
24	4 morn.	336·7	23·1	52·4
	7½	337·5	23·9	45·3
	9	337·7	24·3	42·5
	10	337·6	25·6	42·3
	12	337·1	26·2	45·2 sky misty.
	2½ aftern.	336·4	26·4	45·8
	4½	336·3	26·2	46·3
	5¾	336·6	23·7	47·0
	9	337·1	24·3	53·2 clouds
	11¼	336·8	23·7	52·4
25	7 morn.	337·0	22·5	51·2 serene, azure sky.
	8	337·3	23·5	50·3

The observations of temperature corresponding to mine gave for Cumana, the 23d of January at eleven at night, 26·6°; the 24th of January, half after two in the afternoon, 28·2°; at eleven in the evening, 26·5°; the 26th of January at seven in the morning, 25·5°.

places on the Earth *; that the quantity of heat which it receives in the course of a year is a little greater than that felt at Cumana; but that in the months of November, December, and January †, (at equal distance from the two passages of the Sun through the zenith of the town), the atmosphere cools more at La Guayra. May not this cooling, much slighter than that which is felt almost at the same time at Vera Cruz and at the Havannah, be the effect of the more western position of La Guayra? The aërial ocean, which appears to form only one mass, is agitated by currents, the limits of which are fixed by immutable laws; and it's temperature is variously modified by the configuration of the lands and seas by which it is sustained. It may be subdivided into several basins, which overflow into each other, and of which the most agitated (for instance, that placed over the Gulf of Mexico, or between

* In Asia the mean temperatures of Abushar, of Madras, and of Batavia, are not above 25° and 27°: but the hottest month at Madras rises to 32°, according to Roxburgh; and at Abushar, on the Persian Gulf, according to Mr. Jukes, to 33·9°; which is from two to four degrees higher than at Cairo. See Barrow's Voyage to Cochinchina, p. 180; Malcolm's History of Persia, vol. ii, p. 505; and my essay on the distribution of heat, and the isothermal lines, in the *Mém. de la Société d'Arcueil, Tom. iii.*

† From the middle of the month of January the heat begins to augment at La Guayra.

the Sierra of Santa Martha and the Sea of Darien) have a powerful influence on the cooling and the motion of the neighbouring columns of air. The north winds sometimes cause influxes and counter currents in the south-west part of the Caribbean Sea, which seem, during particular months, to diminish the heat as far as Terra Firma.

At the time of my abode at La Guayra, the scourge of yellow fever, or *calentura amarilla*, had been known only two years; and the mortality had not been considerable, because the confluence of strangers on the coast of Caraccas was less than at the Havannah and Vera Cruz. A few individuals, even Creoles and Mulattoes, were sometimes taken off suddenly by certain irregular remittent fevers; which, from being complicated with bilious appearances, hemorrhages, and other symptoms equally alarming, appeared to have some analogy with the yellow fever. They were generally men employed in the hard labour of cutting wood; in the forests, for instance, in the neighbourhood of the little port of Carupano, or the Gulf of Santa-Fe, west of Cumana. Their death often alarmed the unseasoned Europeans, in towns that were regarded as eminently healthy; but the seeds of the sporadical malady by which they had been attacked were propagated no farther. On the coast of Terra

Firma, the real typhus of America, which is known by the names *vomito prieto* (the black vomit) and of yellow fever, and which ought to be considered as a morbid affection *sui generis*, was known only at Porto Cabello, at Carthagena, and at Santa Martha, where Gastelbondo had observed and described it in 1729. The Spaniards, who had recently disembarked, and the inhabitants of the valley of Caraccas, were not then afraid to reside at La Guayra. They complained only of the oppressive heat, which prevailed during a great part of the year. If they opposed themselves to the immediate action of the Sun, they dreaded at most only those inflammations of the skin or eyes, which are felt every where in the torrid zone, and which are often accompanied by a febrile affection, and powerful congestions in the head. Many individuals preferred the ardent but uniform climate of La Guayra to the cool but extremely variable climate of Caraccas; and scarcely any mention was made of the insalubrity of that port.

Since the year 1797 every thing has changed. Commerce being opened to other vessels than those of the mother country, seamen born in colder climates than Spain, and consequently more sensible to the impressions of the climate of the torrid zone, began to frequent La Guayra. The yellow fever declared itself; North

Americans, seized with the typhus, were received in the Spanish hospitals; and it was affirmed, that they had *imported* the contagion, and that, before they entered the road, the disease had appeared on board a brig, which came from Philadelphia. The captain of the brig denied the fact; and asserted, that, far from having introduced this malady, his sailors had caught it in the port. We know from what happened at Cadiz in 1800, how difficult it is to elucidate facts, when their uncertainty serves to favour theories, that are diametrically opposite. The more enlightened inhabitants of Caraccas and La Guayra, divided in opinion, like the physicians in Europe and the United States, on the principle of contagion of the yellow fever, cited the instance of the same American vessel to prove, some, that the typhus came from abroad, and others, that it took birth in the country itself. Those who embraced the latter system admitted, that an extraordinary alteration had been caused in the constitution of the atmosphere by the overflowings of the Rio de La Guayra. This torrent, which in general is not ten inches deep, was swelled after sixty hours rain in the mountains, in so extraordinary a manner, that it bore down trunks of trees, and masses of rock of a considerable size. During this augmentation, the waters were from thirty to forty feet in breadth, and

from eight to ten feet in depth. It was supposed that they had issued from some subterraneous basin, formed by successive infiltrations into the recently cleared arable lands. Many houses were carried away by the torrent; and the inundation became more dangerous for the stores, in consequence of the gate of the town, which could alone have given an issue to the waters, being accidentally shut. It was necessary to make a breach in the wall on the seaside; more than thirty persons perished, and the damage was computed at half a million of piastres. The stagnant waters, which infected the stores, the cellars, and the dungeons of the public prison, no doubt diffused miasmata in the air, which, as predisposing causes, may have accelerated the developement of the yellow fever; but I believe that the inundation of the Rio de la Guayra was as little the primary cause, as the overflowings of the Guadalquiver, the Xenil, and Gual-Medina, were at Seville, at Ecija, or at Malaga, in the fatal epidemics of 1800 and 1804. I examined with attention the bed of the torrent of La Guayra; and saw there only a barren soil, blocks of mica-slate and gneiss, containing pyrites, and broken off from the Sierra de Avila, but nothing that could have had any effect on the purity of the air.

Since the years 1797 and 1798, the same in

which there was a dreadful mortality at Philadelphia, Santa Lucia *, and St. Domingo, the yellow fever has continued it's ravages at La Guayra. It has proved fatal not only to the troops newly arrived from Spain, but also to those which had been raised far from the coasts, in the Llanos between Calabozo and Uritucu, in a region almost as hot as La Guayra, but favourable to health. This latter phenomenon would surprise us more, if we did not know, that even the natives of Vera Cruz, who are not attacked with the typhus in their own town, sometimes sink under it in the epidemics of the Havannah and the United States †. As the black vomit finds an insurmountable limit at the Encero (four hundred and seventy-six toises high) on the declivity of the mountains of Mexico, on the road to Xalapa, where the oaks and a cool and delicious climate begin; the yellow fever scarcely ever passes beyond the ridge of mountains, that separates La Guayra from the valley of Caraccas. This valley has been exempted from it for a long time; for we must not confound the *vomito* and the yellow fever with the irregular and bilious fevers. The Cumbre and the Cerro de Avila form a very useful rampart to the town of Caraccas,

* Gillespie, on the Disease of his Majesty's Squadron in the Antilles, 1800, p. 17.

† *Nouv. Esp*, vol ii, p. 772.

the elevation of which a little exceeds that of the Encero, but of which the mean temperature is above that of Xalapa.

I have published in another work * the physical observations made by Mr. Bonpland and myself on the locality of towns, that are periodically subject to the scourge of the yellow fever; and I shall not hazard here any new conjectures on the changes observed in the *pathogenic* constitution of particular cities. The more I reflect on this subject, the more mysterious appears to me all that relates to those gaseous emanations, which we call so vaguely the seeds of contagion, and which are supposed to be developed by a corrupted air, destroyed by cold, conveyed from place to place in garments, and attached to the walls of houses. How can we explain why, during the eighteen years which preceded the year 1794, there was not one single instance of the *vomito* at Vera Cruz, though the concourse of unseasoned Europeans and of Mexicans from the interior, was very considerable; though the sailors indulged in the same excesses, with which they are still reproached; and though the town was not so clean as it has been since the year 1800?

The following is the series of pathological facts, considered in their greatest simplicity.

* *Nouv. Esp.* Tom. ii, p. 752—788.

When a great number of persons, born in a cold climate, arrive at the same time in a port of the torrid zone, not particularly dreaded by navigators, the typhus of America begins to appear. Those persons have not had the typhus during their passage; it manifests itself among them only on the very spot. Is the atmospheric constitution changed? or does a new form of disease display itself among individuals, whose irritability is highly increased?

The typhus soon begins to exert it's ravages among other Europeans, born in more southern countries. If it propagate itself by contagion, it seems surprising, that in the towns of the equinoctial continent it does not attach itself to certain streets; and that immediate contact* does not augment the danger, any more than seclusion diminishes it. The sick, when removed to the inland country, and especially to cooler and more elevated spots, to Xalapa, for instance, do not communicate the typhus to the inhabitants of those places, either because

* In the oriental plague (another typhus characterized by a great disorder in the lymphatic system) immediate contact is less to be feared than is generally thought. Mr. Larrey asserts, that the tumefied glands may be touched, or cauterized without danger; but he thinks we ought not to risk putting on the clothes of persons attacked with the plague. *Mém. sur les Maladies de l'Armée Francoise en Egypte*, p. 35.

it is not contagious in it's nature, or that the predisposing causes are not the same as in the regions of the shore. When there is a considerable diminution of the temperature, the epidemy usually ceases, even on the spot where it first appeared. It again begins at the approach of the hot season, and sometimes long before; though during several months there has been no sick person in the harbour, and no ship has entered it.

The typhus of America appears to be confined to the shore, either because those persons who bring* the disease disembark there, and goods supposed to be impregnated with deleterious miasmata are there accumulated; or because on the seaside gaseous emanations of a particular nature are formed. The aspect of the places where typhus exerts it's ravages seems often to exclude all idea of a local or endemical origin. It has been seen to prevail in the Canaries, the Bermudas, and among the smaller West India Islands, in dry places formerly distinguished for the great salubrity of their climate. Examples of the propagation of the yellow fever in the inland parts of the torrid zone appear very doubtful; this malady may have been confounded with remitting bilious fevers. With respect to the temperate zone,

* Bailly, *de la Fièvre jaune*, 1814, p. 421.

in which the contagious character of the typhus of America is more decided, the disease has indubitably spread far from the shore, even into very elevated places, exposed to cool and dry winds, as in Spain, at Medina-Sidonia, at Carlotta, and the city of Murcia. That variety of phenomena, which the same epidemic exhibits, according to the difference of climates, the union of predisposing causes, it's shorter or longer duration, and the degree of it's *exacerbation*, should render us extremely circumspect in tracing the secret causes of the American typhus. An enlightened observer, who, at the time of the violent epidemics in 1802 and 1803, was chief physician to the colony of St. Domingo, and who has studied that disease in the Island of Cuba, the United States, and Spain, Mr. Bailly, thinks like me, "that the typhus is very often, but not always, contagious *."

Since the yellow fever has made such cruel ravages in La Guayra, the want of cleanliness in that little town has been exaggerated, like that of Vera Cruz, and of the quays or wharfs of Philadelphia. In a place where the soil is extremely dry, destitute of vegetation, and where a few drops of water scarcely fall in seven or eight months, the causes, that produce what are called miasmata, cannot be very

* Bailly, as above &c., p. xii (*Nouv. Esp.*, Tom. ii, p. 771).

frequent. The streets of La Guayra appeared to me in general to be tolerably clean, with the exception of the quarter of the slaughter-houses. The sea-side has no beach, on which the remains of fuci and of mollusca are heaped up; but the neighbouring coast, which stretches to the east toward Cape Codera, and consequently to the windward of La Guayra, is extremely unhealthy. Intermitting, putrid, and bilious fevers often prevail at Macuto, and at Caravalleda; and, when from time to time the breeze is interrupted by a westerly wind, the little bay of Cotia, which I shall often have occasion to mention, sends an air loaded with putrid emanations toward the coast of La Guayra, notwithstanding the rampart opposed by Cape Blanco.

The irritability of the organs being so different in the people of the north and those of the south, it cannot be doubted, that with a greater freedom of commerce, and a more frequent and intimate communication between countries situate in different climates, the yellow fever will extend it's ravages in the New World. It is even probable, that the concurrence of so many exciting causes, and their action on individuals so differently organized, may give birth to new forms of disease, and new deviations of the vital powers. This is one of the evils, that inevitably attend a rising civilization.

To point it out is not to regret barbarism; it is not to partake the opinions of those, who would break the bands that unite nations, not in order to render the ports of the colonies more healthy, but to thwart the introduction of knowledge, and slacken the progress of reason.

The yellow fever and the black vomit cease periodically at the Havannah and Vera Cruz, when the north winds bring the cold air of Canada toward the Gulf of Mexico. But from the extreme equality of temperature, which characterizes the climates of Porto-Cabello, La Guayra, New Barcelona, and Cumana, it may be feared, that the typhus will there become permanent, whenever, from a great concourse of strangers, it has acquired a high degree of exacerbation. Happily the mortality has diminished since the treatment of this epidemic has been varied, according to the character it presents in different years; and since the different stages of the disease have been better studied, which are recognized by symptoms of inflammation, and of *ataxy* or debility. It would, I think, be unjust to deny the success, which the new system of medicine has obtained over this terrible scourge; yet the persuasion of this success has not made much progress in the colonies. It is there said pretty generally, "that the physicians now explain the course of the disease in a more satisfactory manner than they

did formerly, but that they do not cure it better: that heretofore the patient was left to die slowly, taking no other remedy than an infusion of tamarinds; and that in our days a more active practice carries him to the grave in a more direct and expeditious manner."

This opinion is not founded upon an accurate knowledge of what was done formerly in the West India islands. The voyage of Father Labat sufficiently demonstrates, that in the beginning of the 18th century the physicians of the West Indies did not suffer the sick to die so tranquilly, as seems to be supposed. They did not then kill by emetics, bark, and opium, employed in too large doses, and unseasonably; but by frequent bleedings, and the abuse of purgatives. The physicians indeed seemed so well aware of the effects of their treatment, that they had the candour "to present themselves at the bed-side of the sick, accompanied at their first visit by a confessor and a notary." At present, in neat and well conducted hospitals, they often succeed in reducing the number of deaths to eighteen or fifteen in a hundred, and even a little less. But whenever the sick are crowded together, the mortality increases to one half, or even to three quarters, of which the French army in St. Domingo afforded an example in 1802.

I found the latitude of La Guayra to be

10° 36′ 19″; and the longitude 69° 26′ 13″ *. The dip of the needle on the 24th of January, 1800, was 42·20°; and it's variation 4° 20′ 35″ east. The intensity of the magnetic forces was found proportional to 237 oscillations.

In following the granitic coast of La Guayra toward the west, we find between this port, which is in fact but an ill-sheltered roadstead, and that of Porto Cabello, several indentations of the land, furnishing excellent anchorage for ships. Such are the small bay of Catia, Los Arecifes, Puerto-la-Cruz, Choroni, Sienega de Ocumare, Turiamo, Burburata, and Patanebo. All these ports, with the exception of that of Burburata, from which mules are exported to Jamaica, are now frequented only by small coasting vessels, which are there laden with provision and cacao from the surrounding plantations. The inhabitants of Caraccas, those at least who have more extensive views, feel a great interest in the anchorage of Catia, to the west of Cape Blanco. Mr. Bonpland and myself examined this point of the coast during our second abode at La Guayra. A ravin, of which we shall speak hereafter, known by the name of the *Quebrada de Tipe,* descends from

* Espinosa fixes, on the authority of Mr. Ferrer, the northern part of the town in the latitude of 10° 36′ 40″. *Memorias de los Navegantes Espanoles,* 1809, Tom. ii, Part iv, p. 24.

the table-land of Caraccas towards Catia. A design has long been formed of making a waggon road through this ravin, and of abandoning the ancient road to La Guayra, which resembles the passage over St. Gothard. According to this plan, the port of Catia, equally large and safe, would replace that of La Guayra. Unsafe, would replace that of La Guayra. Unfortunately, however, all that shore, to leeward of Cape Blanco, abounds with mangroves, and is extremely unhealthy. I ascended to the summit of the promontory, that forms Cabo Blanco, in order to observe at the look-out the passage of the Sun over the meridian. I wished to compare in the morning the altitudes taken with an artificial horizon and those taken with the horizon of the sea; to verify the apparent depression of the latter, by the barometrical measurement of the hill *. By this method,

* Barometer, at the level of the sea, 337·3°; therm. 28°. Barometer at the look-out, on the summit of Cape Blanco, 332·8 (in lines of the ancient *pied de roi*); Therm. 27·2°. Height, 65 toises. I found at the look-out the angle between the house of the Manilla Company at La Guayra, and the tower of Maiquitia, 11° 31′ 25″; between that house and Point Niguata, 14° 58′ 35″. The longitudinal axis of the Cape, forming an elongated promontory, is in the direction of N. 81° east; the most salient part, that in the middle, points N. 47° east; at La Guayra, (the elevation of my eye being thirty-three feet) I saw the look-out of the Cape at an angle of 1° 12′ of altitude; which, combined with the barometrical measurement, gives 3316 toises for the distance.

hitherto very little employed, on reducing the heights of the Sun to the same time, a reflecting instrument may be used like an instrument furnished with a level. I found the latitude of the Cape, which is not marked on the maps of the *Deposito Hydrografico* of Madrid, in other respects so exact, to be 10° 36′ 45″; I could only make use of the angles which gave the image of the Sun reflected on a plane glass; the horizon of the sea was very misty, and the windings of the coast prevented me from taking the height of the Sun on that horizon.

The environs of Cape Blanco are not uninteresting for the study of rocks. The gneiss here passes to the state of mica-slate *, and contains, along the seacoast, layers of schistose chlorite †. In this latter I found garnets and magnetical sand. On the road to Catia we see the chloritic schistus passing into hornblende schistus ‡. All these formations are found together in the primitive mountains of the Old World, especially in the north of Europe. The sea at the foot of Cape Blanco throws up on the beach rolled fragments of a rock,

(*Obs. Ast.*, Tom. i, p. 192.) Jefferys, in the *West India Pilot*, 1783, places Cape Blanco twenty minutes, or almost seven leagues, west from La Guayra.

* *Glimmerschiefer.*

† *Chloritschiefer.*

‡ *Hornblendschiefer.*

which is a granular mixture of hornblende and lamellar feldspar. It is what is rather vaguely called *primitive grunstein*. In it we can recognize traces of quartz and pyrites. Submarine rocks probably exist near the coast, which furnish these very hard masses. I have compared them in my journal to the *paterlestein* of Fichtelberg, in Franconia, which is also a diabase, but so fusible, that glass buttons are made of it, which are employed for the slave-trade on the coast of Guinea. I believed at first, according to the analogy of the phenomena which the mountains of Franconia furnish *, that the presence of these hornblende masses with crystals of common (uncompact) feldspar indicated the proximity of transition rocks; but in the high valley of Caraccas, near Antimano, balls of the same diabase fill a vein crossing the mica-slate. On the western declivity of the hill of Cape Blanco, the gneiss is covered with a formation of sandstone, or agglomerate, extremely recent. This sandstone combines angular fragments of gneiss, quartz, and chlorit, magnetical sand, madrepores, and petrified bivalve shells. Is this formation of the same date as that of Punta Araya and Cumana? I sent numerous specimens of it to the cabinet of the King of Spain at Madrid.

* Near Schauenstein, and Steben, where the carburetted transition schist predominates.

Scarcely any part of the coast has so burning a climate as the environs of Cape Blanco. We suffered much by the heat, augmented by the reverberation of a barren and dusty soil; but without feeling any bad consequences from the effects of *insolation.* The powerful action of the Sun on the cerebral functions is extremely dreaded at La Guayra, especially at the period when the yellow fever begins to be felt. Being one day on the terrace of the house, to observe at noon the difference of the thermometer in the sun and in the shade, I saw a man approaching behind me, who conjured me to swallow a potion, which he held prepared in his hand. He was a physician, who had observed me from his window, during half an hour, bareheaded, and exposed to the rays of the Sun. He assured me, that, born in a very northern climate, I should infallibly, after the imprudence I had committed, feel symptoms of the yellow fever that very evening, if I obstinately refused to take the preservative against it. I was not alarmed by this prediction, however serious, believing myself to have been long seasoned; but how could I avoid yielding to entreaties, that had so benevolent a motive? I swallowed the dose; and the physician perhaps reckoned me among the number of the sick, whom he had saved in the course of the year.

After having described the scenery, and the atmospheric constitution of La Guayra, we shall now leave the coasts of the Caribbean Sea, scarcely to behold them again before our return from the Missions of the Oroonoko. The road that leads from the port to Caraccas, the capital of a government of near 900,000 inhabitants, resembles, as I have already observed, the passages over the Alps, the road of St. Gothard, and of the Great St. Bernard. Taking the level of the road had never been attempted before my arrival in the province of Venezuela. No precise idea had even been formed of the elevation of the valley of Caraccas. It had indeed been long observed, that the descent was much less from La Cumbre and *Las Vueltas*, which is the culminating point of the road toward the Pastora at the entrance of the valley of Caraccas, than toward the port of La Guayra: but the mountain of Avila having a very considerable bulk, the eye cannot discover at the same time the points to be compared. It is even impossible to form a precise idea of the elevation of Caraccas from the climate of the valley. The air in it is cooled by the descending currents of air; and by the fogs, which envelop the lofty summit of the Silla during a great part of the year. I have often gone on foot from La Guayra to Caraccas; and I sketched a profile of the road, founded on

twelve points, the heights of which were determined by barometric measurements *. I have often earnestly wished, that my levelling should be repeated and rendered correct by some well informed traveller, who may visit this country, at once so picturesque and so interesting to the natural philosopher.

When in the season of the great heats we breathe the burning atmosphere of La Guayra, and turn our eyes toward the mountains, we are strongly affected by the idea, that, at the

* The following are the barometrical observations, and their results. Maiquetia, 335·0; therm. 25·6°. La Venta, a large inn on the northern slope of La Cumbre, or the Cerro de Avila, bar. 294·1; therm. 19·2°. El Guayavo, or the little Venta de la Cumbre, 285·3; therm. 18·7°. Fort of La Cuchilla, 281·5; therm. 18·8°. Venta chica de Sanchorquiz, 284·2; therm. 18·7°. Near the spring of Sanchorquiz (la Fuente), 286·4; therm. 18·6°. Last little Venta, before arriving at the Cross of La Guayra 284·1; therm. 18·8°. The Cross of La Guayra, 292·2; therm. 19·6°. The Custom House of Caraccas, Aduana de la Pastora, barom. 301·3; therm. 15·1°. Caraccas at the Trinidad, barom. 303·7; therm. 15·2° (See my *Obs. Ast.*, Tom. i, p. 296 et 367). The results calculated are perhaps somewhat too little. The barometrical heights have been reduced to the same time, by an exact knowledge of the effect of the small atmospheric tides. The absolute elevation of the barometer at the level of the sea here indicates less than the same instrument gave, when carefully rectified in the point 0 of the scale. The differences only are the question here.

direct distance of five or six thousand toises, a population of forty thousand souls, assembled in a narrow valley, enjoys all the coolness of spring, of a temperature which at night descends to 12° of the centesimal thermometer. This near approach of different climates is common in the Cordilleras of the Andes; but every where, at Mexico, at Quito, in Peru, and in New Grenada, a long journey must be made into the interior, either by the plains, or by proceeding up the rivers, in order to reach the great cities, which are the centres of civilization. The height of Caraccas is but a third of that of Mexico, Quito, and Santa Fe de Bogota; yet among all the capitals of Spanish America, which enjoy a cool and delicious climate in the midst of the torrid zone, Caraccas stands nearest to the coast. What a privilege, to possess a seaport at three leagues distance, and to be situate among mountains, on a table-land, which would produce wheat, if the cultivation of the coffee-tree were not preferred!

The road from La Guayra to the Valley of Caraccas is infinitely finer than that from Honda to Santa Fe, or that from Guayaquil to Quito. It is even kept in better order than the ancient road, which led from the port of Vera Cruz to Perote, on the eastern declivity of the mountains of New Spain. With good mules it requires but three hours, to go from the port

of La Guayra to Caraccas; and only two hours to return. With loaded mules, or on foot, the journey is from four to five hours. The ascent begins with a ridge of rocks extremely steep, and stations that bear the name of Torre quemada, Curucuti, and Salto, to a large inn (La Venta) built at six hundred toises above the level of the sea. The denomination of the *Burnt Tower* indicates the sensation that is felt in descending toward La Guayra. A suffocating heat is reflected by the walls of rock, and still more by the barren plains, on which the traveller looks down. On this road, as on that from Vera Cruz to Mexico, and wherever on a rapid declivity the climate changes, the increase of muscular strength and the sensation of well-being, that we experience as we advance into strata of cooler air, have always appeared to me less striking than that feeling of languor and weakness, which seizes on the frame, when we descend toward the burning plains of the coast. Such is the organization of man, that, even in the moral world, we are less soothed by what meliorates our condition, than affected by a new sensation of pain.

From Curucuti to Salto the ascent is somewhat less laborious. The windings of the road contribute to render the declivity easier, as in the old road over Mount Cenis. The *Leap*, or *Salto*, is a crevice, which is passed on a draw-

bridge. Real fortifications crown the summit of the mountain. We saw at Venta the thermometer at noon at 19·3°, when at La Guayra it kept up at the same hour to 26·2°. Since the period when neutrals have been from time to time admitted into the ports of the Spanish colonies, strangers having been more easily permitted to ascend to Caraccas than to Mexico, La Venta already enjoys some celebrity in Europe and in the United States, for the beauty of it's scenery. This spot does indeed, when the clouds permit, present a magnificent view of the sea, and the neighbouring coasts. You discover an horizon of more than twenty-two leagues radius; the white and barren shore reflects a dazzling mass of light; you see at your feet Cape Blanco, the village of Maiquetia with it's cocoa-trees, La Guayra, and vessels that enter the port. But I found this view far more extraordinary, when the sky was not serene, and trains of clouds, strongly illumined on their upper surface, seemed projected like floating islands on the surface of the ocean. Strata of vapour, hovering at different heights, formed intermediary spaces between the eye and the lower regions. From an illusion easily explained, they enlarged the scene, and rendered it more solemn. Trees and dwellings discovered themselves from time to time through the openings, which were left by the clouds driven on

by the winds, and rolling over one another. Objects then appear at a greater depth, than when seen through a pure and uniformly serene air. On the declivity of the mountains of Mexico, at the same height (between Las Trancas and Xalapa*), the sea is at twelve leagues distance, and the view of the coast is confused; while on the road from La Guayra to Caraccas we command the plains (the *tierra caliente*) as from the top of a tower. We may conceive the impression, which this aspect must leave on persons, who, born in inland countries, contemplate the sea and ships for the first time from this point.

I determined by direct observations the latitude of the Venta, to enable myself to give a more precise idea of the distance of the coasts. The latitude is 10° 33′ 9″. It's longitude appeared to me by the chronometer † nearly 2′ 47″ west of the town of Caraccas. I found the dip of the needle at this height to be 41·75°, and the intensity of the magnetic force equal to two hundred and thirty four oscillations. From the Venta, called also *Venta Grande* to distinguish it from three or four small inns established

* See the profile published in my Atlas of New Spain, Plate 12.

† The altitudes of the sun, which I took on the 20th of January, 1800, were very near the meridian. (*Obs. Ast.* Tom. i, p. 186.)

in my time * along the road, there is still an ascent of one hundred and fifty toises to reach Guayavo. This is nearly the most lofty point of the way. I carried the barometer still farther, a little above La Cumbre †, to the little fort of La Cuchilla. Being without a passport (for during five years I had never needed one, but at the moment of disembarking), I had nearly been arrested by a post of artillerymen. To calm the anger of these old soldiers I translated for them into Castilian *varas* the number of toises their post was above the level of the sea. This seemed however to interest them little, and I owed my liberty solely to an Andalusian, who became very tractable, when I told him, that the mountains of his country, the Sierra Nevada of Grenada, were far more lofty than all the mountains in the province of Caraccas.

The fort of Cuchilla is of the height of the top of the Puy de Dome; or nearly one hundred and fifty toises lower than the post-house of Mount Cenis. The town of Caraccas, the Venta del Guayavo, and the port of La Guayra, being so near each other, Mr. Bonpland and I wished to have observed simultaneously, during a few successive days, the extent of the little barometrical tides, in

* They are almost all destroyed at present.

† The *top*, the *summit*.

a valley of such small breadth, on a table-land exposed to the winds, and near the seacoast; but the atmosphere was not sufficiently calm during our abode in those parts, nor was I furnished with the triple apparatus of meteorological instruments, which those experiments required, and which I recommend to those natural philosophers who may hereafter visit that country.

When I passed for the first time that table-land, on my way to the capital of Venezuela, I found several travellers assembled round the little inn of Guayavo, to rest their mules. They were inhabitants of Caraccas, and were disputing on the efforts toward independence, which had been made a short time before. Joseph Espana had perished on the scaffold; and his wife groaned in a prison, because she had given an asylum to her husband when a fugigive, and had not denounced him to the government. I was struck with the agitation which prevailed in every mind, and the bitterness with which questions were debated, on which men of the same country ought not to have differed in opinion. While they descanted on the hatred of the Mulattoes against the free Negroes and whites, on the wealth of the monks, and the difficulty of holding slaves in obedience, a cold wind, that seemed to descend from the lofty summit of the Silla of Caraccas, enve-

loped us in a thick fog, and put an end to this animated conversation. We sought for shelter, in the Venta del Guayavo. When we entered the inn, an old man, who had spoken with the most calmness, reminded the others how imprudent it was, in a time of denunciation, on the mountain as well as in the city, to engage in political discussions. These words, uttered in a spot of so wild an aspect, made a lively impression on my mind; which was often renewed during our journies in the Andes of New Grenada and Peru. In Europe, where nations decide their quarrels in the plains, we climb the mountains in search of solitude and liberty. In the New World, the Cordilleras are inhabited to the height of twelve thousand feet; and thither men carry with them their political dissentions, and their little and hateful passions. Gaming-houses are established on the ridge of the Andes, wherever the discovery of mines has led to the foundation of towns; and in those vast solitudes, almost above the region of the clouds, in the midst of objects fitted to elevate the thoughts, the news of a decoration, or a title refused by the court, often disturbs the happiness of families.

Whether we gaze on the distant horizon of the sea, or direct our looks to the south-east, toward that serrated ridge of rocks, which seems to unite the Cumbre and the Silla, though se-

parated from them by the ravin *(quebrada)* of Tocume, every where we admire the grand character of the landscape. From Guayavo we proceed for half an hour over a smooth table-land, covered with alpine plants. This part of the way, on account of it's windings, is called *Las Vueltas*. We find a little higher up the barracks or magazines of flour, which were constructed by the Guipuzcoa company in a spot of cool temperature, when they had the exclusive monopoly of the trade of Caraccas, and supplying it with provision. On the road to Las Vueltas we see for the first time the capital, standing three hundred toises below, in a valley luxuriantly planted with coffee and European fruit trees. Travellers are accustomed to stop near a fine spring, known by the name of Fuente de Sanchorquiz, that descends from the Sierra on sloping strata of gneiss. I found it's temperature 16·4°; which, for an elevation of seven hundred and twenty-six toises, is a considerable coolness; and it would appear still greater, to those who drink it's limpid water, if, instead of gushing out between La Cumbre and the temperate valley of Caraccas, it were found on the descent toward La Guayra. But I have observed, that at this descent on the northern side of the mountain, the rock*,

* Hor. 8·3; dip 40° south-east.

by an uncommon exception in that country, does not dip to the north-west, but to the south-east, which prevents the subterraneous waters from forming springs there.

We continued to descend from the small ravin of Sanchorquiz to la Cruz de la Guayra; a cross erected on an open spot, six hundred and thirty-two toises high, and thence (entering by the customhouse and the quarter of the Pastora) to the city of Caraccas. On the south side of the mountain of Avila, the gneiss presents several geognostical phenomena worthy of the attention of travellers. It is traversed by veins of quartz, containing canulated and often articulated prisms of rutile titanite of two or three lines in diameter. In the fissures of the quartz we find, on breaking it, very thin crystals, which crossing each other form a kind of network. Sometimes* the red schorl occurs only in dendritic crystals of a bright red. The gneiss of the valley of Caraccas is characterized by the red and green garnets, which it includes, and which disappear when the rock passes into mica-slate. This same phenomenon has been remarked by Mr. Von Buch in Sweden in Helsingland, while in the temperate parts of Europe garnets are in general contained in the serpentine and mica-slates, not in gneiss. In

* Especially below the Cross of La Guayra, at 594 toises of absolute elevation.

the inclosures of the gardens of Caraccas, erected partly with fragments of gneiss, we find garnets of a very fine red, a little transparent, and very difficult to detach. The gneiss near the Cross of La Guayra, half a league distant from Caraccas, presented me also vestiges of azure copper ore * disseminated in veins of quartz, and small strata of graphite, or earthy carburetted iron. This last, which leaves traces upon paper, is found in pretty large masses, and sometimes mingled with sparry iron ore, in the ravin of Tocume, to the west of the Silla.

Between the spring of Sanchorquiz and the Cross of La Guayra, as well as still higher up, the gneiss contains considerable beds of saccharoidal bluish-gray primitive limestone, coarse grained, containing mica, and traversed by veins of white calcareous spar. The mica, with large folia, lies in the direction of the dip of the strata. I found in the primitive limestone a great many crystallized pyrites, and rhomboidal fragments of sparry iron ore of isabella yellow. All the pains I took to find some tremolite †, which in the Fitchelberg, in Franco-

* Blue carbonated copper.

† Grammatite of Mr. Haüy. The primitive limestone above the spring of Sanchorquiz is directed, as the gneiss in that place, hor. 5·2, and dips 45° north; but the general direction of the gneiss is, in the Cerro de Avila, hor. 3·4,

nia *, is common in the primitive limestone (without dolomite) were useless. In Europe beds of primitive limestone are generally observed in the mica-slates; but we find also saccharoidal limestone in a gneiss of the most ancient formation, in Sweden near Upsal, in Saxony near Burkersdorf, and in the Alps in the road over the Simplon. These situations are analogous to that of Caraccas. The phenomena of geognosy, particularly those which are connected with the stratification of rocks, and their grouping, are never solitary; but are found the same in both hemispheres. I was the more struck with these relations, and this identity of formations, as, at the time I undertook my journey, mineralogists were unacquainted with the name of a single rock of Venezuela, New Grenada, and the Cordilleras of Quito.

with 60° of dip N. W. Exceptions merely local are observed in a small space of ground near the Cross of La Guayra (hor. 6·2 dip 8° N.); and higher up, opposite the Quebrada of Tipe (hor. 12, dip 50° W.)

* Near Wunsiedel.

CHAPTER XII.

General view of the Provinces of Venezuelâ.—Diversity of their interests.—Town and Valley of Caraccas.—Climate.

THE importance of a capital does not depend solely on it's population, it's wealth, or it's site: to be justly appreciated, we must attend to the extent of territory, of which it is the centre; the sum of native productions, that are the object of it's commerce; and it's connection with the provinces, that are subject to it's political influence. These various circumstances are modified by the ties, less or more relaxed, that unite the colonies with the mother country: but such is the empire of habit, and the combinations of commercial interests, that it may be foreseen, that this influence of capitals on the surrounding country, those associations of provinces, blended together under the denomination of kingdoms, general captainries, presidencies, and governments*, will survive even the catastrophe of the separation of the colo-

* *Reinos, Capitanias Generales, Presidencias, Goviernos, Provincias*, are the names, which the Court of Spain has always given to it's transmarine possessions, *dominios de ultramar*.

nies. These dismemberments occur only when, in spite of the natural limits, places have been arbitrarily connected together, and thus find themselves shackled in their communications. In every part of America, where civilization did not exist to a certain degree before the Conquest (as it did in Mexico, Guatimala, Quito, and Peru), it has advanced from the coasts toward the interior, following sometimes the valley of a great river, sometimes a chain of mountains, that afforded a temperate climate. Concentred at once in different points, it has spread itself as by diverging rays. The union into provinces and kingdoms was effected at the first immediate contact between civilized parts, or those at least subject to a permanent and regular sway. Lands deserted, or inhabited by savage nations, now surround the countries, which European civilizatiôn has subdued. They divide it's conquests like arms of the sea difficult to pass, and neighbouring states are often connected with each other only by strips of cultivated land. It is less difficult to acquire a knowledge of the configuration of coasts bathed by the ocean, than of the sinuosities of that interior shore, on which barbarism and civilization, impenetrable forests and cultivated land, touch and bound each other. It is from not having reflected on the early state of society in the New World, that geographers so often

disfigure their maps, by tracing the different parts of the Spanish and Portugueze colonies, as if they were contiguous at every point in the interior. The local knowledge, which I myself obtained, respecting these boundaries, furnishes me with the means of fixing the extent of the great territorial divisions with some certainty, of comparing the wild and inhabited parts, and of appreciating the greater or less political influence exerted by certain towns of America, as centres of power and of commerce.

Caraccas is the capital of a country, which is nearly twice as large as Peru at present, and which yields little in extent to the kingdom of New Grenada *. This country, which the Spanish government designates by the name of *Capitania General de Caraccas* †, or of the *(uni-*

* The Capitania General of Caraccas contains near 48,000 square leagues (twenty five to a degree); Peru since la Paz, Potosi, Charcas, and Santa Cruz de la Sierra, have been separated from it, and joined to the viceroyalty of Buenos Ayres, only 30,000. New Grenada, including the province of Quito, 65,000. These calculations have been made by Mr. Oltmanns, from the alterations that my astronomical observations have introduced into the maps of Spanish America. I prefer here valuations in round numbers; the particular discussions on the magnitude of the various countries, their respective population, and other facts purely statistical, will be placed in particular chapters, as we quit each great territorial division.

† The captain general of Caraccas has the title of *Capitan General de las Provincias de Venezuela y Ciudad de Caraccas.*

ted) provinces of Venezuela, has nearly a million of inhabitants, among whom are sixty thousand slaves. It contains, along the coast, New Andalusia, or the province of Cumana (with the island of Margaretta*), Barcelona, Venezuela or Caraccas, Coro, and Maracaybo; in the interior, the provinces of Varinas and Guiana, the first along the rivers of Santo-Domingo and the Apure, the second along the Oroonoko, the Căsiquiare, the Atabapo, and the Rio Negro. In a general view of the seven united provinces of Terra Firma, we perceive, that they form three distinct zones, extending from east to west.

We find at first cultivated land along the shore, and near the chain of the mountains on the coast; next savannahs or pasturages; and finally, beyond the Oroonoko, a third zone, that of the forests, into which we can penetrate only by means of the rivers that traverse them. If the native inhabitants of the forests lived entirely on the produce of the chace, like those of the Missoury, we might say, that the three zones, into which we have divided the territory of Venezuela, present an image of the three states of human society; the life of the wild hunter, in the woods of the Oroonoko; the

* This Island, near the coast of Cumana, forms a particular *govierno*, depending immediately on the captain-general of Caraccas.

pastoral life, in the savannahs, or llanos; and the agricultural, in the high vallies, and at the foot of the mountains on the coast. Missionary monks and a few soldiers occupy here, as in all America, advanced posts on the frontiers of Brazil. In this first zone are felt the preponderance of force, and the abuse of power, which is a necessary consequence. The natives carry on a civil war, and sometimes devour one another. The monks endeavour to augment the little villages of their Missions, by availing themselves of the dissensions of the natives. The military live in a state of hostility with the monks, whom they were intended to protect. Every thing offers alike the melancholy picture of misery and privations. We shall soon have occasion to examine more closely that state of man, which is vaunted as a state of nature by those who inhabit towns. In the second region, in the plains and the pasture grounds, food is extremely abundant, but has little variety. Although more advanced in civilization, men without the circle of some scattered towns do not remain less isolated from one another. At the view of their dwellings, partly covered with skins and leather, it would seem, that, far from being fixed, they are scarcely encamped in those vast meadows, which extend to the horizon. Agriculture, which alone lays the basis, and draws closer the ties of society, occupies

the third zone, the shore, and especially the hot and temperate valleys in the mountains near the sea.

It may be objected, that in other parts of Spanish and Portugueze America, wherever we can trace the progressive developement of civilization, we find the three ages of society * united. But it ought to be remembered, and this observation is extremely important to those who desire to become thoroughly acquainted with the political state of these colonies, that the disposition of the three zones, that of the forests, the pastures, and the cultivated land, are not every where the same, and that it is no where so regular as in the country of Venezuela. It is far from being always from the coast to the interior, that population, commercial industry, and intellectual improvement diminishes. In Mexico, Peru, and Quito, the table-lands and central mountains display the most numerous assemblage of cultivators, towns nearest to each other, and the more ancient institutions. We even find, that, in the kingdom of Buenos Ayres, the region of pasturage, known by the name of the Pampas, lies between the isolated part of Buenos Ayres, and the great mass of Indian cultivators, who inhabit the Cordilleras of Charcas, La Paz, and

* *Nouv. Esp.*, Tom. i, p. 144.

Potosi. This circumstance gives birth to a diversity of interests, in the same country, between the people of the interior, and those who inhabit the coasts.

Where we seek to form a precise idea of those vast provinces, which have been governed for ages, almost like separate states, by viceroys and captains-general, we must fix our attention at once on several points. We must distinguish the parts of Spanish America that are opposite to Asia, from those that are bathed by the Atlantic Ocean; we must discuss, as we have already done, where the greatest portion of the population is placed; whether near the coast, or concentrated in the interior, on the cold and temperate table-lands of the Cordilleras. We must verify the numerical proportions between the natives and other casts; search into the origin of the European families; and examine to what race, in each part of the colonies, the greater number of whites belong. The Andalusian-Canarians of Venezuela, the mountaineers * and the Biscayans of Mexico, the Catalonians of Buenos Ayres, differ essentially in their aptitude for agriculture, the mechanic arts, commerce, and the objects connected with the unfolding of the intellect. Each

* *Montaneses.* The inhabitants of the mountains of Santander are called by this name in Spain.

of those races has preserved, in the New as in the Old World, the shades that constitute it's national physiognomy; it's harshness or mildness of character; it's moderation, or it's excessive desire of gain; it's kind hospitality, or it's taste for solitude. In the countries where the population is for the most part composed of Indians and mingled casts, the difference, that manifests itself between the Europeans and their descendants, cannot indeed be so strongly marked, as that which was observed anciently in the colonies of Ionian and Doric origin. The Spaniards transplanted to the torrid zone having become under new skies strangers to the remembrances of their mother country, must have felt more sensible changes than the Greeks settled on the coasts of Asia Minor, and of Italy, the climates of which differ so little from those of Athens and Corinth. It cannot be denied, that the character of the Spanish Americans has received different modifications from the physical constitution of the country; the isolated site of the capitals on the table-lands, or in the vicinity of the coasts; the agricultural life; the labour of the mines, and the habit of commercial speculations: but in the inhabitants of Caraccas, Santa Fe, Quito, and Buenos Ayres, we recognize every where something that belongs to the race, and the situation of the people.

If we examine the state of the Capitania-General of Caraccas, according to the principles we have laid down, we perceive that it's agricultural industry, it's great mass of population, it's numerous towns, and whatever is connected with an advanced civilization, are found near the coast. This coast extends farther than two hundred leagues. It is bathed by the Little Caribbean Sea, a sort of mediterranean, on the shores of which almost all the nations of Europe have founded colonies; which communicates at several points with the Atlantic Ocean; and the existence of which has had a considerable influence on the progress of knowledge in the eastern part of Equinoctial America, from the time of the Conquest. The kingdoms of New Grenada and Mexico have no connection with foreign colonies, and through them with that part of Europe which is not Spanish, except by the ports of Carthagena and of Santa Martha, of Vera Cruz and of Campeachy. These vast countries, from the nature of their coasts, and the remoteness of their population on the back of the Cordilleras, present few points of contact with foreign lands. The Gulf of Mexico is even less frequented during a part of the year, on account of the danger of gales of wind from the north. The coasts of Venezuela, on the contrary, from their extent, their stretching toward the east, the number of their ports, and

the safety of their anchorage at different seasons, possess all the advantages of the interior Caribbean Sea. The communications with the greater islands, and even with those that are to windward, can no where be more frequent than from the ports of Cûmana, Barcelona, La Guayra, Porto Cabello, Coro, and Maracaybo; and no where has it been found more difficult to restrain an illicit commerce with strangers. Can we wonder, that this facility of commercial intercourse with the inhabitants of free America, and the agitated nations of Europe, should have augmented in conjunction, in the provinces united under the Capitania-General of Venezuela, opulence, knowledge, and that restless desire of a local government, which is blended with the love of liberty and republican forms?

The copper-coloured natives, or Indians, constitute a very important mass of the agricultural population only in those places, where the Spaniards found regular governments, a civil community, and ancient and very complicated institutions, at the Conquest; as in New Spain, south of Durango; and in Peru, from Cusco to Potosi. In the Capitania-General of Caraccas, the Indian population is inconsiderable, at least beyond the Missions, and in the cultivated zone. At the moments of great political dissentions, the natives excite no fear

in the whites, or the mingled casts. Computing, in 1800, the total population of the seven united provinces at nine hundred thousand souls, it appeared to me, that the Indians made only one ninth; while at Mexico they form nearly one half of the inhabitants.

Among the casts that compose the population of Venezuela, that of the Blacks, which awakens at once the interest due to misfortune, and the dread of a violent reaction, is not important from it's number; but it is so from it's accumulation on a small space of territory. We shall soon see, that in all the Capitania-General the slaves do not exceed a fifteenth of the whole population. In the island of Cuba, of all those in the West Indies where the Negroes bear the smallest proportion to the Whites, they were, in 1811, as one to three. The seven united provinces of Venezuela have sixty thousand slaves; Cuba, the extent of which is eight times less, has two hundred and twelve thousand. Considering the sea of the West India islands, of which the Gulf of Mexico makes a part, as an interior sea with several mouths, it is important to fix our attention on the political relations, that result from this singular configuration of the New Continent, between countries placed around the same basin. Notwithstanding the isolated state, in which the greater part of the mother countries endeavour to

hold their colonies, the agitations that take place are not the less communicated from one to the other. The elements of discord are every where the same; and, as if by instinct, a concert is established between men of the same colour, although separated by difference of language, and inhabiting opposite coasts. That American Mediterranean, formed by the shores of Venezuela, New Grenada, Mexico, the United States *, and the West India islands, may count upon it's borders near a million and a half of free and enslaved Blacks; but so unequally distributed, that there are very few to the south, and scarcely any in the region of the west. Their great accumulation is on the northern and eastern coasts. This may be said to be the African part of the interior basin. It is natural, that the commotions, which since 1792 have manifested themselves in St. Domingo, should have been propagated to the coasts of Venezuela. So long as Spain possessed those fine colonies in tranquillity, the little resistance of the slaves was entirely repressed: but when a struggle of another kind, that for independence, began, the Blacks by their me-

* The produce of the states at the back of the Alleghany mountains is exported by the Missisippi; and the possession of Florida is so strongly desired by the Anglo-Americans, only with a view of occupying a greater extent of coast on the interior sea.

nacing position excited alternately the apprehensions of the opposite parties; and the gradual or instantaneous abolition of slavery has been proclaimed in different regions of Spanish America, less from motives of justice and humanity, than to secure the aid of an intrepid race of men, habituated to privation, and fighting for their own cause. I found in the narrative of the voyage of Girolamo Benzoni a curious passage, which proves of how old a date are the apprehensions caused by the increase of the black population. Those fears will cease only where governments shall second by laws the progressive meliorations, which refinement of manners, opinion, and religious sentiment, introduce into domestic slavery. "The Negroes," says Benzoni, "multiply so much at St. Domingo, that in 1545, when I was in Terra Firma (on the coast of Caraccas), I saw many Spaniards, who had no doubt that the island would shortly be the property of the blacks *." It was reserved for our age, to see this pre-

* Vi sono molti Spagnuoli, che tengono per cosa certa, che quest' isola (San Dominico) in breve tempo sara posseduta da questi Mori di Guinea. (Benzoni, *Hist. del Mondo Nuovo*, ed. 2da, 1572, p. 65.) The author, who is not very scrupulous in the adoption of statistical facts, believes, that in his time there were at St. Domingo seven thousand fugitive Negroes (*Mori cimaroni*), with whom Don Luis Colomb made a treaty of peace and friendship.

diction accomplished; and a European colony of America transform itself into an African state.

The sixty thousand * slaves, which the seven united provinces of Venezuela contain, are so unequally divided, that in the province of Caraccas alone there are nearly forty thousand, one fifth of which are Mulattoes; in that of Maracaybo, ten or twelve thousand; in those of Cumana and Barcelona, scarcely six thousand.

* This estimation differs only one tenth from that, which I published in my work on Mexico, Tom. ii, p. 748; which terminates by general considerations respecting all the Spanish Colonies. Strongly interested to know with precision the black population of America, I had formed on the spot in 1800, after consulting rich proprietors (*haciendados*), partial lists for the vallies of Caraccas, Caucagua, Guapo, Guatire, Aragua, Ocumare, &c. These estimations gave for the province of Venezuela thirty-two thousand five hundred slaves; for all the Capitania-general of Caraccas, fifty-four thousand, instead of two hundred and eighteen thousand Blacks, which Mr. Depons indicates, supposing (no doubt from an error in the figures) that the Blacks form nearly a third (three tenths) of the whole population. (*Voyage à la Terre-Ferme*, Tome 1, p. 178 et 241.) The computations which I had collected during my abode at Caraccas, at Cumana, and in Spanish Guiana, have been recently submitted to new verifications, by the care of Don Manuel Palacio-Faxardo, who has published a very interesting account of the carbonat of soda, or *urao* of Luganilla, and whose three journals of the road from Santa-Fe to Varinas, from Caraccas to the Llanos of Pore, and from Merida to Truxillo, afforded me valuable materials for rectifying the geographical maps.

To judge of the influence which the slaves and the men of colour exert in general on the public tranquillity, it is not enough to know their number, we must consider their accumulation at certain points, and their manner of life, as cultivators or inhabitants of towns. In the province of Venezuela, the slaves are assembled together on a space of no great extent, between the coast, and a line that passes (at twelve leagues from the coast) through Panaquire, Yare, Sabana de Ocumare, Villa de Cura, and Nirgua. The Llanos or vast plains of Calaboso, San Carlos, Guanare, and Barquecimeto, contain only four or five thousand, who are scattered among the farms, and employed in the care of cattle. The number of freed men is very considerable; the Spanish laws and customs are favourable to affranchisement. A master cannot refuse liberty to a slave who offers him the sum of three hundred piastres, even though he may have cost him double that price, on account of his industry, or a particular aptitude for the trade he practises. Instances of persons, who by their will bestow liberty on a certain number of slaves, is more common in the province of Venezuela, than in any other place. A short time before we visited the fertile vallies of Aragua, and the lake of Valencia, a lady, who inhabited the great village of Victoria, ordered her children, on her deathbed, to give liberty to all her slaves, to the num-

ber of thirty. I love to record facts, that do honour to the character of a people, from whom Mr. Bonpland and myself received so many marks of kindness and affection.

What is most interesting in the colonies next to the state of the Blacks, is to know the number of white Creoles, whom I call Hispano-Americans *, and that of the Whites born in Europe. It is difficult to acquire notions sufficiently exact on so delicate a point. The people in the New, as well as the Old World, abhor numberings, suspecting them to be made in order to augment the weight of taxes. The men in office, on the other hand, sent by the mother-country to the colonies, dislike these statistical enumerations as much as the people, and this from motives of a jealous policy. These numberings, so irksome to make, are not easily withheld from the curiosity of the planters. Although ministers at Madrid, aware of the real interests of their country, have endeavoured from time to time, to obtain precise information respecting the increasing prosperity of the colonies, the local authorities have not in general seconded these useful views. It required direct orders from

* In imitation of the word Anglo-American, adopted in all the languages of Europe. In the Spanish colonies, the Whites born in America are called *Spaniards;* and the real Spaniards, those who are born in the mother-country, *Europeans*, *Gachupins*, or *Chapetons*.

the court of Spain, to have those excellent notions of political economy delivered to the editors of the Peruvian Mercury, which they have published. It was in Mexico, and not at Madrid, that I heard Count de Revillagigedo, the viceroy, blamed for having informed all New Spain, that the capital of a country, which has six millions of inhabitants, contained in 1790 only two thousand three hundred Europeans, while it was computed, that there were more than fifty thousand Hispano-Americans. The persons who uttered these complaints considered the fine establishment of posts, by which a letter travels from Buenos Ayres to New California, as one of the most dangerous conceptions of Count Florida Blança. They counselled (happily without success) the rooting up of the vines of New Mexico and Chili, in order to favour the commerce of the mother country. Strange blindness, which can make it believed, that numberings will reveal to the colonies the consciousness of their strength! It is only in times of discord and internal troubles, that an examination of the relative preponderance of casts, that ought all to be animated by one interest, seems intended to estimate beforehand the number of combatants.

If we compare the seven united provinces of Venezuela to the kingdom of Mexico and the island of Cuba, we shall succeed in finding the

approximate number of white Creoles, and even of Europeans. The first, or Hispano-Americans, form in Mexico nearly one fifth, and in the island of Cuba, according to the very accurate ennumeration of 1801, a third of the whole population. When we reflect, that the kingdom of Mexico is inhabited by two millions and a half of natives of the copper-coloured race; when we consider the state of the coasts, that are bathed by the Pacific Ocean, and the small number of Whites in the intendencies of Puebla and Oaxaca, comparatively with the natives; we cannot doubt, that the province of Venezuela at least, if not the Capitania-General, has a greater proportion than that of one to five. The island of Cuba *, in which the Whites are even more numerous than in Chili, may furnish us with a limiting number, that is to say, the *maximum* that can be supposed in the Capitania-General of Caraccas. I believe we must stop at two hundred, or two hundred and ten thousand Hispano-Americans, in a total population of nine hundred thousand souls. The number of Europeans included in the white race (not comprehending the troops sent from the mother country) does not exceed twelve or fifteen thou-

* I do not mention the kingdom of Buenos-Ayres, where, among a million of inhabitants, the whites are extremely numerous in the parts toward the coast; while the table-lands, or provinces of the Sierra, are almost entirely peopled with natives.

sand. It certainly is not greater at Mexico than sixty thousand; and I find by several statements, that, if we estimate the whole of the Spanish Colonies at fourteen or fifteen millions of inhabitants, there are in this number at most three millions of Creole Whites, and two hundred thousand Europeans.

When the young Tupac-Amaru, who believed himself the legitimate heir to the empire of the incas, made the conquest of several provinces of Upper Peru, in 1781, at the head of forty thousand Indian mountaineers, all the Whites were seized with the same apprehensions. The Hispano-Americans felt, like the Spaniards born in Europe, that the contest was between the Copper-coloured race and the Whites; between barbarism and civilization. Tupac-Amaru, who himself was not destitute of intellectual cultivation, began with flattering the Creoles and the European clergy; but soon drawn on by events, and the spirit of vengeance that inspired his nephew, Andrew Condorcanqui, he changed his plan. A rising for independence became a cruel war between the different casts: the Whites were conquerors, and, excited by a feeling of common interest, from that period fixed a wakeful attention on the proportions, that exist in the different provinces between their number and that of the Indians. It was reserved for our times, to see the whites direct this attention toward them

selves; and examine, from motives of distrust, the elements of which their cast is composed. Every enterprise in favour of independence and liberty puts the national or American party in opposition with the men of the mother country. When I arrived at Caraccas, the latter had just escaped from the danger, with which they thought they were menaced by the insurrection projected by Espana. The consequences of that bold attempt were the more serious, because, instead of investigating the real causes of the popular discontent, it was thought, that the mother country would be saved by employing vigorous measures. At present the commotions, which have arisen throughout the country, from the banks of the Rio de la Plata to New Mexico, an extent of fourteen hundred leagues, have divided men of a common origin.

It seems to excite surprise in Europe, that the Spaniards of the mother country, of whom we have remarked the small number, have made during ages so long and so firm a resistance. Men forget, that the European party in all the colonies is necessarily augmented by a great mass of the natives. Family interests, the desire of uninterrupted tranquillity, the fear of engaging in an enterprise that might fail, prevent these latter from embracing the cause of independence, or aspiring to establish a local and representative government, though depen-

dent on the mother country. Some shrink from violent measures, and flatter themselves, that a gradual reform may render the colonial system less oppressive. They see in revolutions only the loss of their slaves, the spoliation of the clergy, and the introduction of religious toleration, which they believe to be incompatible with the purity of the established worship. Others belong to the small number of families, which, either from hereditary opulence, or having been long settled in the colonies, exercise a real municipal aristocracy. They would rather be deprived of certain rights, than share them with all; they would prefer even a foreign yoke to the exercise of authority by the Americans of an inferior cast; they abhor every constitution founded on equality of rights; and above all, they dread the loss of those decorations and titles, which they have with so much difficulty acquired, and which, as we have observed above, compose so essential a part of their domestic happiness. Others again, and their number is very considerable, live in the country on the produce of their lands; and enjoy that liberty, which, in a country where there is only a scattered population, is obtained even under the most oppressive governments. Aspiring to no places themselves, they see them with indifference filled by men, whose power can never reach them, and whose names are to them

almost unknown. They would no doubt prefer a national government, and complete liberty of commerce, to the ancient state of the colonies; but this desire does not sufficiently subdue the love of ease, and the habits of an indolent life, to impel them to long and painful sacrifices.

In characterizing these different tendencies of political opinion in the colonies, from the various intercourse I have had with all classes of the inhabitants, I have developped the causes of the long and peaceful dominion of the mother country over America. The calm has been the result of habit, of the preponderance of a few leading families, and above all of the equilibrium established between the hostile forces. But security founded on disunion must be shaken, whenever a large body of men, forgetting their individual animosities, shall be united by a sentiment of common interest; when that sentiment, once awakened, is strengthened by resistance; and when the progress of knowledge, and change of manners, shall diminish the influence of habit and ancient ideas.

We have seen above, that the Indian population in the united provinces of Venezuela is not considerable, is recently civilized, and that all the towns have been founded by the Spanish conquerors. These could not follow,

as in Mexico and Peru, the traces of the ancient civilization of the natives. Caraccas, Maracaybo, Cumana, and Coro, have nothing Indian but their names. Compared with the three capitals * of Equinoctial America, placed on the mountains, and enjoying a temperate climate, Caraccas is the least elevated. The great population of Venezuela lying toward the coast, and the most cultivated region being parallel to it in the direction of east and west, Caraccas is not a centre of commerce, like Mexico, Santa Fe de Bogota, and Quito. Each of the seven provinces united in one Capitania-General has a port, by which it's produce is sent out. It is sufficient to consider the position of the provinces, their more or less intimate connection with the Windward Islands, the direction of the mountains, and the course of the great rivers, to perceive, that Caraccas can never exert any powerful political influence over the countries, of which it is the capital. The Apure, the Meta, and the Oroonoko, running from west to east, receive all the streams of the Llanos, and the region of pasturage. St. Thomas in Guiana will be necessarily, at some future day, a place of trade of high im-

* Mexico, Santa Fe de Bogota, and Quito. The elevation of the site of the capital of Guatimala is still unknown. From it's vegetable productions we may infer, that it is less than 500 toises.

portance, especially when the flour of New Grenada, embarked above the confluence of the Rio Negro and the Umadea, and descending by the Meta and Oroonoko, shall be preferred at Caraccas and Guiana to the flour of New England. It is a great advantage to the provinces of Venezuela, that their territorial wealth is not directed to one point, like that of Mexico and New Grenada, which flows to Vera Cruz and Carthagena; but that they possess a great number of towns equally well peopled, and forming so many various centres of commerce and civilization.

Caraccas is the seat of an *Audiencia* (high court of justice) and one of the eight archbishoprics, into which Spanish America is divided*.

* The archbishopricks and the audiencias have not the same limits as the great political divisions, which, independent of one another, are known under the names of viceroyalties, and *capitanias-generales*. There are often two *audiencias* in the same viceroyalty, as those of Mexico and Guadalaxara, of Lima and of Cusco; sometimes the bishops of one viceroyalty are suffragans of an archbishop, who resides in another political division. The bishops of Panama, Mainas, Quito, and Cuenca, are subject to the archbishop of Lima, and not to the archbishop of New Grenada. The eight archbishops of Spanish America have their sees at Mexico, Guatimala, St. Domingo, the Havannah, Caraccas, Santa-Fe de Bogota, Lima, and Chuquisaca or Charcas. The twelve audiencias are those of Mexico, Guadalaxara, Guatimala, the Havannah, Caraccas, Santa Fe de Bogota,

It's population in 1800, according to the researches I made into the number of births, was nearly 40,000; the best informed inhabitants believed it even to be 45,000, of which 18,000 are whites, and 27,000 free men of colour. Computations made in 1778 had already given from 30,000 to 32,000. All the direct numberings have remained a quarter, and more, below the effective number. In 1766, the population of Caraccas, and the fine valley in which that city is placed, suffered immensely by a severe attack of the small pox. The mortality rose in the town to six or eight thousand. Since that memorable period, inoculation is become general, and I have seen it practised

Quito, Lima, Cusco, Chuquisaca, Santiago in Chili, and Buenos Ayres. Finally, the eleven great political divisions are the viceroyalty of Mexico (with two commanders general, in the *provincias internas*, and the Captain-General of Yucatan); the Capitanias-generales of Guatimala, the two Floridas, Cuba, St. Domingo, Porto-Rico, and Venezuela; the viceroyalty of New Grenada (with the presidencia of Quito); those of Peru and Buenos-Ayres; and the Capitania General of Chili. There are only four viceroyalties; but Chili, Quito, and Guatimala have always borne in Spain officially the title of kingdoms, *reinos*. The president of an audiencia may be subject to a viceroy; for instance, the president of Quito depends in civil and military affairs on the viceroy of Santa-Fe. I thought it proper to record here these triple divisions of the judicial, ecclesiastical, and political hierarchies, because they are often confounded in works, that treat of the Spanish Colonies.

without the aid of physicians. In the province of Cumana, where the communications with Europe are less frequent, there had not been, in my time, one instance of the small-pox during fifteen years; while at Caraccas that cruel malady was constantly dreaded, because it always showed itself sporadically on several points at a time. I say sporadically, for in Equinoctial America, where the changes of the atmosphere, and the phenomena of organic life, seem subject to a remarkable periodicalness, the small-pox, before the benevolent introduction of the vaccine disease, exerted it's ravages only, if we may place confidence in general belief, every fifteen or twenty years. Since my return to Europe, the population of Caraccas has continued to augment. It amounted to 50,000 souls; when, at the great earthquake of the 26th of March, 1812, twelve thousand inhabitants perished beneath the ruins of their houses. The political events, which have succeeded this catastrophe, have reduced the number of inhabitants to less than 20,000; but these losses will soon be repaired, if the fertile and commercial country, of which Caraccas is the centre, should have the happiness of enjoying repose, and a wise administration, for a few years.

The town is seated at the entrance of the plain of Chacao, which extends three leagues

east toward Caurimare and the Cuesta de Auyamas, and which is two leagues and a half in breadth. This plain, through which runs the Rio Guayra, is four hundred and fourteen toises in height above the level of the sea. The ground, which the town of Caraccas occupies, is uneven, and has a steep slope from N. N. W. to S. S. E. In order to form an exact idea of the situation of Caraccas, we must recollect the general disposition of the mountains of the coast, and the great longitudinal vallies, by which they are traversed. The river Guayra rises in the group of primitive mountains of Higuerota, which separates the valley of Caraccas from that of Aragua. It is formed near Las Ajuntas by the junction of the little rivers of San Pedro and Macarao, and runs first to the east as far as the Cuesta of Auyamas, and then to the south, to unite it's waters with those of Rio Tuy, below Yare. The Rio Tuy is the only considerable river in the northern and mountainous part of the province.

It follows regularly the direction from west to east for thirty leagues, in a straight line, more than three quarters of which are navigable. By barometrical measurements I found the slope of the Tuy for this length, from the plantation of Manterola* to it's mouth, east of Cape Co-

* At the foot of the high mountain of Cocuyza, 3′ east from Victoria.

dera, two hundred and ninety-five toises. This river forms in the chain of the coast a kind of longitudinal valley, while the waters of the Llanos, or of five sixths of the province of Caraccas, follow the slope of the land toward the south, and join the Oroonoko. This hydrographic sketch may throw some light on the natural tendency of the inhabitants of the same province, to export their productions by different roads.

If the valley of Caraccas be only a lateral branch of that of the Tuy, the two valleys still remain parallel during some time. They are separated by hilly ground, which we cross in going from Caraccas to the high savannahs of Ocumare, passing by Le Valle and Salamanca. These savannahs themselves are beyond the Tuy; and the valley of the Tuy being a great deal lower than that of Caraccas, the descent is almost constantly from north to south. In the same manner as Cape Codera, the Silla, the Cerro de Avila between Caraccas and La Guayra, and the mountains of Mariara, constitute the most northern and elevated range of the mountains of the coast; the mountains of Panaquire, Ocumare, Guiripa, and the villa de Cura, form the most southern range. We have already several times observed, that the general direction of the strata composing this vast chain of the coast is from south-west to

north-east; and their dip is usually toward the north-west. Hence it follows that the direction of the primitive strata is independent of that of the whole chain; and, what is extremely remarkable, in following this chain* from Porto Cabello as far as Maniquarez and Macanao, in the island of Margaretta, we find, from west to east, first granite; then gneiss, mica-slate, and primitive schistus; and finally compact limestone, gypsum, and agglomerates containing seashells.

It is to be regretted, that the town of Caraccas was not built farther to the east, below the entrance of the Anauco into the Guayra; on that spot near Chacao, where the valley widens into an extensive plain, which seems to have been levelled by the abode of the waters. Diego de Losada, when he founded † the town, followed no doubt the traces of the first establishment made by Faxardo. The Spaniards at that time, attracted by the reputation of the two gold mines of Los Teques and Baruta, were not yet masters of the whole val-

* I have spoken in the preceding chapter, p. 376, of the interruption in the chain of the coast to the east of Cape Codera.

† The foundation of Santiago de Leon de Carraccas dates from 1567, and posterior to that of Cumana, Coro, Nueva Barcelona, and Caravalleda, or El Collado. *Fray Pedro Simon*, Not. 7, cap. iii, p. 575. *Oviedo y Banos*, p. 262.

ley, and preferred remaining near the road, which led to the coast. The town of Quito also is built in the narrowest and most uneven part of a valley, between two fine plains, Turupamba and Rumipamba, of which great advantages might have been taken, had the ancient Indian habitations been abandoned.

The descent is continual from the customhouse of the Pastora, by the square of Trinidad and the *Plaza Major*, to Santa Rosalia, and the Rio Guayra. I found by barometrical measurements, that the customhouse was thirty toises above the square of Trinidad, near which I made my astronomical observations; this square, eight toises higher than the pavement of the cathedral in the great square; and the great square, thirty-two toises above the Rio Guayra at la Noria. This declivity of the ground does not prevent carriages from going about the town; but the inhabitants make little use of them. Three small rivers, descending from the mountains, the Anauco, the Catuche, and the Caraguata, cross the town from north to south; their banks are very high; and, with the dried up ravins which join them furrowing the ground, remind the traveller of the famous Guaicos of Quito *, only being on a smaller scale. The water drunk at Caraccas

* See chap. iv, vol. ii, p. 228.

is that of the Rio Catuche; but the richer class have their water brought from La Valle, a village a league distant on the south. This water and that of Gamboa are reckoned very salubrious, because they flow over the roots of sarsaparilla *. I could not discover in them any aromatic or extractive matter. The water of the valley does not contain any lime, but a little more carbonic acid than the water of the Anauco. The new bridge over this river is a handsome structure, and is frequented by those, who walk toward Candelaria, on the road to Chacao and Petare. Caraccas contains eight churches, five convents, and a theatre that holds fifteen or eighteen hundred persons. When I was there, the pit, where the men are separate from the women, was uncovered. We saw at once the actors, and the stars. As the misty weather made me lose a great many observations of Jupiter's satellites, I was able to ascertain from a box in the theatre whether the planet would be visible that night. The streets of Caraccas are wide, straight, and crossing each other at right angles, as in all the towns built by the Spaniards in America. The

* Throughout America the waters are supposed to share the properties of those plants, under the shade of which they flow. Thus at the straits of Magellan that water is much praised, which touches the roots of the canella winterana. *Viage al Magellanes*, 1788, p. 315.

houses are spacious, and higher than they ought to be in a country subject to earthquakes. In 1800, the two squares of Alta Gracia and St. Francis presented a very agreeable aspect; I say, in the year 1800, because the terrible shocks of the 26th of March, 1812, destroyed almost the whole city. It rises slowly from it's ruins. The quarter of Trinidad, where I resided, was overturned as if a mine had been sprung underneath it.

The small extent of the valley, and the proximity of the high mountains of Avila and the Silla, give a gloomy and stern character to the scenery of Caraccas; particularly in that part of the year, when the coolest temperature prevails, in the months of November and December. The mornings are then very fine; and on a clear and serene sky we perceived the two domes or rounded pyramids of the Silla, and the craggy ridge of the Cerro de Avila. But toward the evening the atmosphere thickens; the mountains are covered; streams of vapour cling to their ever-green slopes, and seem to divide them into zones one above another. These zones are gradually blended together; the cold air, which descends from the Silla, accumulates in the valley, and condenses the light vapours into large fleecy clouds. These often descend below the Cross of La Guayra, and advance, gliding on the soil, to-

ward the Pastora of Caraccas, and the adjacent quarter of Trinidad. At the view of this misty sky, I could scarcely think myself in one of the temperate valleys of the torrid zone; but rather in the north of Germany, among the pines and the larches overshadowing the mountains of the Hartz.

But this gloomy and melancholy aspect, this contrast between the clearness of the morning, and the cloudy sky of the evening, are not observed in the midst of summer. The nights of June and July are clear and delicious. The atmosphere then preserves, almost without interruption, that purity and transparency, which are peculiar to table-lands and all elevated valleys in calm weather, and as long as the winds do not mix strata of air of unequal temperature. This is the season for enjoying all the beauty of a landscape, which I saw illumined only a few days at the end of January. The two rounded summits of the Silla are beheld at Caraccas, almost under the same angles of elevation* as the peak of Teneriffe at the port of Orotava. The first half of the mountain is covered with short grass; then succeeds the zone of evergreen trees, which reflects a purple light at the season, when the befaria,

* I found, at the square of Trinidad, the apparent height of the Silla 11° 12′ 49″. It was about four thousand five hundred toises distant.

the alpine rosetree * of equinoctial America, is in blossom. The rocky masses rise above this zone in the form of woody domes. Destitute of vegetation, they increased by the nakedness of their surface the apparent height of a mountain, which in temperate Europe would scarcely enter on the limit of perpetual snows. The cultivated region of the valley, and the gay fields of Chacao, Petare, and La Vega, form an agreeable contrast to the imposing aspect of the Silla, and the great heavings of the ground on the north of the town.

The climate of Caraccas has often been called a *perpetual spring*. It is found every where, half way up the Cordilleras of Equinoctial America, between four hundred and nine hundred toises of elevation, unless the great breadth of the valley joined to an arid soil causes an extraordinary intensity † of radiant caloric. What indeed can we imagine more delightful, than a temperature, which in the day keeps between 20° and 26° ‡; and at night between 16° and 18° §, which is equally favourable to the plantain (cambury), the orange-tree, the coffee-tree, the apple, the apricot, and corn? A

* Rhododendron ferrugineum of the Alps.

† As at Carthago and Ibagua in New Grenada. See my *Proleg. de Distrib. Geogr. Plant.*, p. 98.

‡ Between 16° and 20·8° Reaum.

§ Between 12·8° and 14·4° Reaum.

national writer* compares the situation of Caraccas to the terrestrial Paradise, and recognizes in the Anauco and the neighbouring torrents the four rivers of the Garden of Eden.

It is to be regretted, that such a temperate climate is generally inconstant and variable. The inhabitants of Caraccas complain of having several seasons in the same day; and of the rapid change from one season to another. In the month of January for instance, a night, of which the mean temperature is 16°, is followed by a day, when the thermometer during eight successive hours keeps above 22° in the shade. In the same day, we find the temperature of 24° and 18°. These oscillations are extremely common in our temperate climate of Europe, but under the torrid zone, the Europeans themselves are so accustomed to the uniform action of exterior stimulus, that they suffer from a change of temperature of 6°. At Cumana, and every where in the plains, the temperature from eleven in the morning to eleven at night changes only 2° or 3°. Moreover, these variations act on the human frame at Caraccas more violently than could be supposed from the mere indications of the thermometer. In this narrow valley the atmosphere is in some sort balanced be-

* The Historiographer of Venezuela, Jose de Oviedo y Banos.

tween two winds, one that comes from the west, or the seaside, and the other from the east, or the inland country. The first is known by the name of the wind of Catia, because it blows from Catia to the west of Cape Blanco through the ravin of Tipe, which we have already noticed, in speaking of a new road and a new port projected to replace the road and the port of La Guayra. The wind of Catia has only the appearance of a western wind; it is oftener the breeze of the east and north-east, which, rushing with extreme impetuosity, ingulfs itself in the Quebreda de Tipe. Reflected by the high mountains of Aguas Negras, this wind goes up toward Caraccas, by the side of the hospital of the Capuchins, and the Rio Caraguata. It is loaded with humidity, which it deposits as it's temperature decreases, and consequently the summit of the Silla is wrapped in clouds, when the *catia* blows in the valley. This wind is dreaded by the inhabitants of Caraccas; it causes headaches to those persons, whose nervous system is irritable. I have known some, who, in order to shun it's effects, shut themselves up in their houses, as people do in Italy when the sirocco blows. I thought I had perceived during my stay at Caraccas, that the wind of Catia was purer (a little richer in oxigen) than the *wind of Petare*. I even imagined, that it's purity might explain it's exciting pro-

perty. But the means I employed deserved little confidence. The wind of Petare coming from the east and south-east, by the eastern extremity of the valley of the Guayra, brings from the mountains and interior of the country a dryer air, which dissipates the clouds, and the summit of the Silla rises in all it's beauty.

We know that the modifications brought by the winds in the composition of the air, in various places, entirely escape our eudiometrical experiments; the most exact of which can estimate only as far as 0·003° of oxygen. Chemistry does not yet possess any means of distinguishing two jars filled, one with the air of the sirocco or the catia, and the other before these winds are felt. It appears to me probable, that the singular effects of the catia, and of all those currents of air, to the influence of which popular opinion attributes so much importance, must be looked for rather in the changes of humidity and of temperature, than in chemical modifications. We need not have recourse to miasmăta brought to Caraccas from the unhealthy shore on the coast: it may be easily conceived, that men accustomed to the drier air of the mountains and the interior, must be disagreeably affected, when the very humid air of the sea, pressed through the gap of Tipe, reaches in an ascending current the

high valley of Caraccas, and, getting cooler by it's dilatation, and by it's contact with the adjacent strata, deposits a great portion of the water it contains. This inconstancy of climate, these somewhat rapid transitions from a dry and transparent air to air humid and misty, are inconveniences, which Caraccas shares in common with the whole temperate region of the tropics, with all the places situate between four and eight hundred toises of elevation, either on table-lands of small extent, or on the slope of the Cordilleras, as at Xalapa in Mexico, and Guaduas in New Grenada. A serenity uninterrupted during a great part of the year prevails only in the low regions at the level of the sea, and at considerable heights on those vast table-lands, where the uniform radiation of the soil seems to contribute to the perfect dissolution of vesicular vapours. The intermediate zone is at the same height as the first strata of clouds, that surround the surface of the Earth; and the climate of this zone, the temperature of which is so mild, is essentially misty and variable.

Notwithstanding the elevation of the spot, the sky is generally less blue at Caraccas than at Cumana. The aqueous vapour is less perfectly dissolved; and here, as in our climates, a greater diffusion of light diminishes the intensity of the aërial colour, by introducing white

into the blue * of the air. This intensity, measured with the cyanometer of Saussure, was found from November to January generally 18°, never above 20°. On the coasts it was from 22° to 25°. I remarked in the village of Caraccas, that the wind of Petare sometimes contributes singularly to give a pale tint to the celestial vault. On the 22d of January, the blue of the sky was at noon in the zenith feebler than I ever saw it in the torrid zone †. It corresponded only to 12° of the cyanometer. The atmosphere was then remarkably transparent, without clouds, and of extraordinary dryness. The moment the wind of Petare ceased, the blue colour rose at the zenith as high as 16°. I have often observed at sea, but in a smaller degree, a similar effect of the wind on the colour of the serenest sky.

We know less exactly the mean temperature of Caraccas, than that of Santa Fe de Bogota, and of Mexico. I believe however I can demonstrate, that it cannot be very distant from twenty or twenty-two degrees. I found by my own observations during the three very cool

* See ch. iii, vol. ii, p. 101 and foll.

† At noon, thermometer in the shade 23·7° (in the sun, out of the wind, 30·4°; Deluc's hygrometer, 36·2°; cyanometer at the zenith, 12°, at the horizon 9°. The wind ceased at three in the afternoon. Th. 21°; hygr. 39.3°; cyan. 16°. At six o'clock, therm. 20·2°; hygr. 39°.

months of November, December, and January, taking each day the maximum and minimum of the temperature, the heights were 20·2°; 20·1°; 20·2°. Now from the knowledge we have acquired of the distribution of heat in the different seasons, and at different elevations above the level of the sea, I can deduce within a certain approximation, from the means of a few months, that of the whole year; almost in the same manner as we determine the meridian altitude of a star, by elevations measured out of the meridian. The following are the considerations on which are founded the results I adopt. At Santa Fe de Bogota, the month of January, according to Mr. Caldas, differs from the mean of the year only 0·2°. At Mexico, very near the temperate zone, the difference reaches a maximum of 3°. At La Guayra, near Caraccas, the coldest month differs from the annual mean 4·9°; but if the air of La Guayra (and that of Catia) rises sometimes in winter by the *Quebrada de Tipe* to the high valley of Carccas, this valley does not less receive, during a great part of the year, the winds of the east and south-east coming from Caurimare and the inland country. We have learned by direct observations, that at La Guayra and Caraccas the coldest months are 23·2°, and 20·1°. These differences express a decrement of heat, which, in the valley of Caraccas, is the simultaneous effect

of the height of the situation (or of the dilatation of the air in the ascending current) and of the conflict between the winds of Catia and Petare.

According to a small number of observations, made in the course of three years, partly at Caraccas, and partly at Chacao very near the capital, I perceived, that the centigrade thermometer kept in the cold season, in November and December, generally * between 21° and 22° in the day, and at night, between 16° and 17°. In the hot season, in July and August, this instrument rises in the day † to 25° or 26°; and at night to 22° or 23°. This is the habitual state of the atmosphere; and the same observation, made with an instrument which I verified, gave for the mean temperature of the year at Caraccas a little more than 21·5° ‡; which, in the system of cisatlantic climates, is to be met with in the plains in the latitude of 36° or 37°. It is almost unnecessary to observe, that this comparison is founded only on the

* According to the scale of Reaumur, in the day from 16·8° to 18°; at night, from 12·8° to 13·6°.

† In the day from 20° to 20·8°; at night, from 17·6° to 18·4° of the Therm. of Reaum.

‡ 17·2° Reaum. I had stopped in my Prolegomena p. 98, at 13·8° R. For the particular observations, see note E at the end of this volume.

quantity of heat developed in each place during the course of a whole year; and that it extends by no means to the climate, that is, to the distribution of heat in the various seasons.

At Caraccas the heat very seldom rises for a few hours in summer to 29° *. It is asserted, that, a little before the rising of the Sun, it has been seen to fall in winter as low as 11° †. During my stay at Caraccas, the maximum and minimum observed were only 25° and 12·5°. The cold at night is the more intense, from being usually accompanied with a misty sky. I have been unable for whole weeks, to take the altitudes of the Sun, or of the stars. I often found the transition from the purest transparent air to complete obscurity so sudden, that, when I had my eye fixed on a satellite through the glass a minute before it's immersion, I not only lost sight of the planet, but of all the objects close round me, in a mist. Under the temperate zone in Europe, the temperature is more uniform on the high mountains, than in the plains. At the Hospital of St. Gothard, for instance, the difference between the mean temperature of the warmest and coldest months is 17·3°; while, under the same parallel, nearly

* 23·2° R.

† 8·8° R.

at the level of the sea, it is 20° or 21°. The cold does not increase on our mountains so rapidly as the heat diminishes. We shall find as we advance toward the Cordilleras, that under the torrid zone the climate is more uniform in the plains, than on thé mountains. At Cumana and La Guayra (for we must not cite places where the north winds disturb for some months the equilibrium of the atmosphere) the thermometer keeps during the whole year between 21° and 35°. At Santa Fe and Quito we find it vary from 3° to 22°, if we compare, I do not say the days, but the coldest and warmest hours of the year. In the low regions, at Cumana for instance, the nights differ from the days only three or four degrees. At Quito, I found this difference, taking carefully, every day and night, the mean of four or five observations, amounting to seven degrees. At Caraccas, placed on a spot nearly three times less in height, and on a table-land of little extent, the days in the months of November and December are still from 5° to 5·5° hotter than the nights. These phenomena of nocturnal refrigeration may astonish at the first view: they are modified by the table-lands and the mountains being heated during the day, by the action of the descending currents, and above all by the nocturnal radiation of caloric in the pure and dry air of the Cordilleras. The following

are the differences of climate between Caraccas and it's port.

	CARACCAS. Height 454 toises.	LA GUAYRA. Level of the Sea.
Mean temperatnre of the year -	21° to 22°	28°
Mean temp. of the hot season -	24	29
Mean temp. of the cold season -	19	23.5
Maximum - - - - - - - -	29	35
Minimum - - - - - - - -	11	21

Rains are extremely frequent at Caraccas in the months of April, May, and June. The storms always come from the east and south-east, from the side of Petare and La Valle. No hail falls in the low regions of the tropics; yet it occurs at Caraccas almost every four or five years. Hail has even been seen in vallies still lower; and this phenomenon, when it does happen, makes a lively impression on the people. Falls of aërolites are less rare with us, than hail under the torrid zone, notwithstanding the frequency of thunder storms, at three hundred toises of elevation above the level of the sea.

The cool and delightful climate we have been describing agrees also with the culture of equi-

noctial productions. The sugar-cane is cultivated with success, even at heights exceeding that of Caraccas; but in the valley, on account of the dryness of the climate, and the stony soil, the cultivation of the coffee-tree is preferred; which there yields little fruit indeed, but of the finest quality. When the shrub is in blossom, the plain extending beyond Chacao presents a delightful aspect. The banana-tree, which is seen in the plantations near the town, is not the great *platano harton;* but the varieties *camburi* and *dominico,* which require less heat *. The great plantains are brought to the market of Caraccas from the haciendos of Turiamo, situate on the coast between Burburata and Porto Cabello. The highest flavoured pineapples are those of Baruto, of Empedrado, and of the heights of Buenavista, on the road to Victoria. When a traveller ascends for the first time to the valley of Caraccas, he is agreeably surprised to find the culinary plants of our climates, the strawberry, the vine, and almost all the fruit-trees of the temperate zone, growing by the side of the coffee and banana-tree. The apples and peaches esteemed the best come from Macarao, or from the western extremity of the valley. There, the quince-tree, the trunk of which attains only four or five feet in height,

* See ch. ii, vol. i, p. 118, 119.

is so common, that it has almost become wild. Preserved apples and quinces, particularly the latter *, are much used in a country, where it is thought, that, to drink water, thirst must previously be excited by sweetmeats. In proportion as the environs of the town have been cultivated with coffee; and the establishment of plantations, which dates only from the year 1795, has increased the number of agricultural Negroes †; the apple and quince-trees scattered in the savannahs have given place in the valley of Caraccas to maize and pulse. Rice, watered by means of small trenches, was formerly more common than now in the plain of Chacao. I observed in this province, as in Mexico and in all the elevated lands of the torrid zone, that, where the apple-tree is most abundant, the culture of the pear-tree is attended with great difficulties. I have been assured, that near Caraccas the excellent apples sold in the markets come from trees not grafted. Cherry-trees are wanting. The olive-trees, which I saw in the court of the convent

* *Dulce de manzana y de membrillo.*

† The consumption of eatables, and especially meat, is so considerable in the towns of Spanish America, that at Caraccas, in 1800, there were 40,000 oxen killed every year; while at Paris, in the time of Mr. Necker, with a population fourteen times as great, the number amounted only to 70,000.

of San Felipe Neri, were large and fine; but the luxuriance of their vegetation prevents them from bearing fruit.

If the atmospheric constitution of the valley be favourable to the different kinds of culture, upon which colonial industry is founded, it is not equally so to the health of the inhabitants, and the strangers settled in the capital of Venezuela. The great inconstancy of the weather, and the frequent suppression of cutaneous perspiration, give birth to catarrhal affections, which assume the most different forms. A European, once accustomed to the violent heat, enjoys better health at Cumana, in the valley of Aragua, and in every place where the low region of the tropics is not very humid, than at Caraccas, and in those mountain-climates, which are boasted of as the abode of perpetual spring.

Speaking of the yellow fever of La Guayra, I mentioned the opinion generally adopted, that this cruel disease is propagated as little from the coast of Venezuela to the capital, as from the coast of Mexico to Xalapa. This opinion is founded on the experience of the last twenty years. The contagious disorders, which have exerted their ravages in the port of La Guayra, were scarcely felt at Caraccas. I would not disturb, by groundless terrors, the security enjoyed by the inhabitants of the capital; but I

am not convinced, that the American typhus, rendered endemic on the coast as the port becomes more frequented, if it be favoured by particular dispositions of the climate, will not become common in the valley: for the mean temperature of Caraccas is considerable enough, to allow the thermometer in the hottest months to keep between twenty-two and twenty-six degrees *. If there be no doubt that the typhus in the temperate zone is communicated by contact, can we be certain, that in a high degree of exacerbation, it would not be equally contagious by contact under the torrid zone, in places where, within four leagues of the coast, the predisposition of the organs is favoured by the temperature of summer? The situation of Xalapa, on the declivity of the Mexican mountains, promises more security, because this town, less populous, is five times farther distant from the sea than Caraccas, and two hundred and thirty toises higher; and it's mean temperature is three degrees cooler. In 1696, a bishop of Venezuela, Diego de Banos, dedicated a church *(ermita)* to Santa Rosalia of Palermo, for having delivered the capital from the scourge of the black vomit *(vomito negro)* †, after it's ravages had lasted sixteen months. A

* Between 17° and 20·8° R.

† *Ovido y Banos*, p. 269.

mass celebrated every year in the cathedral, in the beginning of September, has perpetuated the memory of this epidemic, in the same manner as processions have fixed in the Spanish colonies the date of the great earthquakes. The year 1696 was indeed very remarkable for the yellow fever, which prevailed with violence in all the West India islands, where it had only begun to establish it's empire † in 1688. But how can we give credit to an epidemical black vomit, which lasted sixteen months without interruption, and which may be said to have passed through that very cool season, when the thermometer at Caraccas falls to twelve or thirteen degrees? Can the typhus be more ancient in the elevated valley of Caraccas, than in the most frequented ports of Terra Firma? According to Ulloa it was unknown in these latter before 1729. I doubt therefore the epidemic of 1696 having been the yellow fever, or the real typhus of America. Black evacuations often accompany bilious remittent fevers; and are no more characteristic than *hematemeses* of that severe disease now known at the Havannah and Vera Cruz by the name of *vomito*. But if no accurate description demonstrate, that the typhus of America existed at Caraccas as early as the end of

† Bally, p. 34.

the seventeenth century, it is unhappily too certain, that this disease carried off in that capital a great number of young European soldiers in 1802. It is terrifying to reflect, that, in the centre of the torrid zone, a table-land four hundred and fifty toises high, but very near the sea, does not preserve the inhabitants from a scourge, which was believed to belong only to the low regions of the coast.

CHAPTER XIII.

Adode at Caraccas.—Mountains that surround the Town.—Excursion to the Summit of the Silla.—Indications of Mines.

I REMAINED two months at Caraccas, where Mr. Bonpland and I lived in a large and nearly solitary house, in the highest part of the town. From a gallery we could survey at once the summit of the Silla, the serrated ridge of the Gallipano, and the charming valley of the Guayra, the rich cultivation of which formed a pleasing contrast with the gloomy curtain of the surrounding mountains. It was the season of drought, and in order to improve the pasturage, the savannahs, and the turf that covers the steepest rocks, were set on fire. These vast conflagrations, viewed from a distance, produce the most singular effects of light. Wherever the savannahs, following the undulating slope of the rocks, have filled up the furrows hollowed out by the waters, the inflamed land appears in a dark night like currents of lava suspended over the valley. Their vivid but steady light assumes a reddish tint, when the wind, descend-

ing from the Silla, accumulates streams of vapour in the low regions. At other times, and this aspect is still more solemn, these luminous bands, enveloped in thick clouds, appear only at intervals, where it is clear; and as the clouds ascend, their edges reflect a splendid light. These various phenomena, so common under the tropics, become still more interesting from the form of the mountain, the disposition of the slopes, and the height of the savannahs covered with alpine grasses. During the day, the wind of Petare, blowing from the east, drives the smoke toward the town, and diminishes the transparency of the air.

If we had reason to be satisfied with the situation of our house, we had still greater cause of satisfaction in the reception we met with from all classes of the inhabitants. I feel it a duty to cite the noble hospitality exercised toward us by the chief of the government, Mr. de Guevara-Vasconzelos, then captain-general of the provinces of Venezuela. Although I had the advantage, which few Spaniards have shared with me, of having successively visited Caraccas, the Havannah, Santa Fé de Bogota, Quito, Lima, and Mexico, and of having been connected in these six capitals of Spanish America with men of all ranks, I shall not venture to decide on the various degrees of civilization, which society has attained in the different colonies. It is

easier to indicate the different shades of national improvement, and the point toward which the unfolding of the intellect tends in preference, than to compare and class things that cannot be investigated under the same point of view. It appeared to me, that a strong tendency toward the study of the sciences prevailed at Mexico and Santa Fé de Bogota; more taste for literature, and whatever can charm an ardent and lively imagination, at Quito and Lima; more accurate notions of the political relations of countries, and more enlarged views on the state of colonies and their mother countries, at the Havannah and Caraccas. The numerous communications with commercial Europe, with that sea of the West Indies, which we have described as a mediterranean with many outlets, have had a powerful influence on the progress of society in the island of Cuba, and in the five provinces of Venezuela. Civilization has in no other part of Spanish America assumed a more European physiognomy. The great number of Indian cultivators, who inhabit Mexico and the interior of New Grenada, have impressed a peculiar, I might almost say an exotic character, on those vast countries. Notwithstanding the increase of the black population, we seem to be nearer Cadiz and the United States at Caraccas and the Havannah, than in any other part of the New World.

Caraccas being situate on the continent, and it's population less mutable than that of the islands, the national manners have been better preserved than at the Havannah. Society does not present very animated and varied pleasures; but that feeling of comfort is experienced in domestic life, which leads to uniform cheerfulness and cordiality united with politeness of manners. There exists at Caraccas, as in every place where a great change in the ideas is preparing, two races of men, we might say two distinct generations; one, of which but a small number remains, preserves a strong attachment for ancient customs, simplicity of manners, and moderation in their desires. They live only in the images of the past. America appears to them a property conquered by their ancestors. Abhorring what is called the enlightened state of the age, they carefully preserve hereditary prejudices as a part of their patrimony. The other class, less occupied even by the present than by the future, have a propensity, often ill-judged, for new habits and ideas. When this tendency is allied to the love of solid instruction, restrained and guided by a strong and enlightened reason, it's effects become beneficial to society. I knew at Caraccas, among the second generation, several men equally distinguished by their taste for study, the mildness of their manners, and the elevation of their sentiments.

I have also known men, who, disdaining all that is excellent in the character, the literature, and the arts of the Spaniards, have lost their national individuality, without having acquired from their connexions with foreigners any just ideas of the real bases of happiness and social order.

Since the reign of Charles V, the corporation spirit and municipal habits having passed from the mother country to the colonies, men take a pleasure at Cumana, and in other commercial towns of Terra Firma, in exaggerating the pretensions to nobility of the most illustrious families of Caraccas, known by the name of *los Mantuanos.* I am ignorant in what manner these pretensions were formerly manifested; but it appeared to me, that the progress of knowledge, and the change effected in manners, have gradually and pretty generally destroyed whatever is offensive in those distinctions among the Whites. In all the colonies there exist two kinds of nobility. One is composed of the Creoles, whose ancestors have very recently filled great stations in America. Their prerogatives are partly founded on the distinction they enjoy in the mother country; and they imagine they can retain them beyond the sea, whatever may be the date of their settlement in the colonies. The other nobility has more of an American cast. It is composed of the

descendants of the *Conquistadores,* that is to say, of the Spaniards who served in the army at the time of the first conquest. Among the warriors who fought with Cortez, Losada, and Pizarro, several belonged to the most distinguished families of the peninsula; others, born in the inferior classes of the people, have illustrated their names by that chivalrous spirit, which prevailed at the beginning of the sixteenth century. I have elsewhere observed *, that in the records of those times of religious and military enthusiasm, we find, among the followers of the great captains, many simple, virtuous, and generous characters, who reprobated the cruelties that stained the glory of the Spanish name, but who, confounded in the mass, have not escaped the general proscription. The name of *Conquistadores* remains the more odious, as the greater number of them, after having outraged peaceful nations, and lived in the midst of opulence, did not experience toward the end of their career those long misfortunes, which appease the hatred of mankind, and sometimes soften the severity of the historian.

But it is not only the progress of ideas, and the conflict between two classes of different origin, which have induced the privileged casts to abandon their pretensions, or at least to

* See chap. v, vol. ii, p. 299.

conceal them carefully. Aristocracy in the Spanish colonies has a counterpoise of another kind, and of which the action becomes every day more powerful. A sentiment of equality among the Whites has penetrated every bosom. Wherever men of colour are either considered as slaves, or as having been enfranchised, what constitutes nobility is hereditary liberty, is the proud boast of having never reckoned among ancestors any but freemen. In the colonies, the colour of the skin is the real badge of nobility. In Mexico, as well as Peru, at Caraccas as in the island of Cuba, a barefooted fellow is often heard exclaiming: "Does that rich white man think himself whiter than I am?" The population which Europe pours into America being very considerable, it may easily be supposed, that the axiom, every white man is noble, *todo blanco es caballero,* must singularly wound the pretensions of a great number of ancient and illustrious European families. But we may observe farther, that the truth of this axiom has long since been recognized in Spain, among a people justly celebrated for probity, industry, and national spirit. Every Biscayan calls himself noble; and there being a greater number of Biscayans in America and the Philippine Islands, than in the peninsula, the Whites of this race have contributed in no small degree, to propagate in the colonies the system of equality among all men,

whose blood has not been contaminated by the African race.

Moreover, the countries of which the inhabitants, even without a representative government, or any institution of peerage, annex so much importance to genealogy, and the advantages of birth, are not always those where the aristocracy of families is the most offensive. We should seek in vain among the natives of Spanish origin that cold and assuming air, which the character of modern civilization seems to have rendered more common in the rest of Europe. Conviviality, candour, and a great simplicity of manners, unite the different classes of society in the colonies, as well as in the mother country. We might even venture to say, that the expressions of vanity and self-love are less offensive, when they retain something of simplicity and frankness.

I found in several families at Caraccas a taste for instruction, a knowledge of the master-pieces of French and Italian literature, and a particular predilection for music, which is cultivated with success, and which, as it always happens in the pursuit of the fine arts, serves to bring the different classes of society nearer to each other. The mathematical sciences, drawing, painting, cannot here boast of any of those establishments, with which royal munificence, and the patriotic zeal of the inhabitants, have

enriched Mexico. In the midst of the marvels of Nature, so rich in productions, no person on this coast was devoted to the study of plants and minerals. In a convent of St. Francis alone I met with a respectable old gentleman*, who calculated the almanac for all the provinces of Venezuela, and who possessed some precise ideas on the state of modern astronomy. Our instruments interested him deeply, and one day our house was filled with all the monks of St. Francis, begging to see a dipping-needle. The curiosity that dwells on physical phenomena is augmented in countries undermined by volcanic fires, and in a climate where nature is at once so overwhelming, and so mysteriously agitated.

When we remember, that in the United States of North America newspapers are published in small towns not exceeding three thousand inhabitants, we may be surprised to learn, that Caraccas, with a population of forty or fifty thousand souls, possessed no printing office before 1806; for we cannot give this name to the presses, which served only from year to year to print a few pages of an almanac, or the pastoral letter of a bishop. The number of those who feel the want of reading is not very considerable, even in the Spanish colonies most

* Father Puerto.

advanced in civilization ; but it would be unjust to attribute to the colonists what was the effect of a jealous policy. A Frenchman, Mr. Delpeche, allied to one of the most respectable families* in the country, has the merit of having first established a printing office at Caraccas. It appears sufficiently extraordinary in modern times, to see an establishment of this kind, affording the greatest means of communication between men, follow, and not precede, a political revolution.

In a country that presents such enchanting views, and at a period when, notwithstanding some symptoms of popular commotions, the greater part of the inhabitants seem only to direct their thoughts toward physical objects, the fertility of the year, the long drought, or the conflict of the two winds of Petare and Catia, I believed that I should find many persons well acquainted with the lofty surrounding mountains. My expectations however, were not realized; we could not discover at Caraccas a single person, who had visited the summit of the Silla. The hunters do not climb so high on the ridges of mountains; and no journies are undertaken in these countries, to gather alpine-plants, to carry a barometer to an elevated spot, or to examine the nature of rocks.

* The family of the *Montillas*.

Accustomed to a uniform and domestic life, they dread fatigue, and sudden changes of climate. It would seem as if they live not to enjoy life, but only to prolong it's duration.

Our walks led us often toward two coffee plantations, the proprietors * of which were men of agreeable manners. These plantations are opposite the Silla de Caraccas. Surveying, with our glasses, the steep declivity of the mountain, and the form of the two peaks by which it is terminated, we could appreciate the difficulties, which we should have to conquer in order to reach it's summit. Angles of elevation, taken with the sextant at our house, had led me to believe, that the summit was not so high above the level of the sea as the great square of Quito. This estimation was far from corresponding with the ideas of the inhabitants of the town. The mountains, which command great towns, acquire from this very circumstance an extraordinary celebrity in both continents. Long before they have been accurately measured, the learned of the country assign to them a height in toises, or Castilian *varas*, of which to entertain the least doubt would wound a national prejudice.

The captain-general, Mr. de Guevara, ordered the *teniente* of Chacao to furnish us with

* Don Andres de Ibarra, and M. Blandin.

guides. They were Blacks, and knew something of the path, leading toward the shore* over the ridge of the mountain, near the western peak of the Silla. This path is frequented by smugglers, but neither the guides, nor the most experienced of the militia, accustomed to pursue the smugglers in those wild spots, had been on the eastern peak, forming the most elevated summit of the Silla. During the whole month of December, the mountain, the angles of elevation of which made me acquainted with the effects of the terrestrial refractions, had appeared only five times without clouds. In this season two serene days seldom succeeding each other, we were advised not to choose a clear day for our excursion, but rather a time when, the clouds not being very elevated, we might hope, after having crossed the first layer of vapours uniformly spread, to enter into a dry and transparent air. We passed the night of the 2d of January in the *estancia* of Gallegos, a plantation of coffee-trees, near which the little river of Chacaito, flowing in a luxuriantly shaded ravin, forms some fine cascades in descending the mountains. The night was pretty clear; and though on the day preceding a fatiguing journey we should have wished to enjoy some repose, Mr. Bonpland and I pass-

* To Caravalleda.

ed the whole night in watching three occultations of the satellites of Jupiter. I had previously determined the instant of the observation; but we missed them all, owing to some error of calculation in the *Connaissance des Temps*. An evil destiny presided over the occultations of the months of December and January. The apparent time had been mistaken for mean time*.

I was singularly disappointed by the accident; and after having observed at the foot of the mountain the intensity of the magnetic forces before sunrise, we set out at five in the morning, accompanied by slaves carrying our instruments. There were eighteen of us, walking one behind another, in a narrow path, traced on a steep acclivity, covered with turf. We endeavoured first to reach a hill, which toward the south-east seems to form a promontory of the Silla. It is connected with the body of the mountain by a narrow dyke, to which the shepherds give the characteristic name of the gate or *Puerta de la Silla*. We reached it about seven. The morning was fine and cool, and the sky till then seemed to favour our excursion. I saw the thermometer keep a little below 14° †. The barometer showed, that we were already six hundred and eighty-five toises above the level

* See my *Obs. Ast.*, Tom. i, p. 180.

† 11·2° Reaum.

of the sea, that is, nearly eighty toises higher than at the Venta, where we enjoyed so magnificent a view of the coast. Our guides thought, that it would require six hours more to reach the summit of the Silla.

We crossed a narrow dike of rocks covered with turf; which led us from the promontory of the Puerta to the ridge of the great mountain. The eye looks down on two vallies, or rather crevices, filled with a thick vegetation. On the right is perceived the ravin, that descends between the two peaks to the farm of *Munoz;* on the left we look over the crevice of Chacaito, the lavish waters of which gush out near the farm of Gallego. The noise of the cascades is heard, while the torrent is unseen, being concealed under a thick shade of erythrina, clusia, and the Indian fig-tree*. Nothing can be more picturesque in a climate, where so many plants have broad, large, shining, and coriaceous leaves, than the aspect of trees at a great depth, and illumined by the almost perpendicular rays of the Sun.

From the Puerta the ascent becomes more steep. We were obliged to bend ourselves considerably forward, to be able to proceed. The

* Ficus nymphæifolia, erythrina *mitis.* Two fine species of mimosa are found in the same valley; inga *fastuosa,* and i. cinerea.

slope is often from 32° to 33°*. We felt the want of cramp irons, or sticks shod with iron. Short grass covered the rocks of gneiss, and it was equally impossible to hold by the grass, or to form steps as in a softer ground. This ascent, attended with more fatigue than danger, discouraged those who accompanied us from the town, and who were unaccustomed to climb mountains. We lost a great deal of time in waiting for them, and we did not resolve to proceed alone, till we saw them descend the mountain instead of climbing up. The weather was growing cloudy; the mist already issued in the form of smoke, and in slender and perpendicular streaks, from the small humid wood which bordered the region of alpine savannahs above us. It seemed as if a fire had burst forth at once on several points of the forest. These streaks of vapour gradually heaped together, and rising above the ground, were carried along by the morning breeze, and glided like a light cloud over the rounded summit of the mountain.

Mr. Bonpland and I foresaw from these in-

* Since my experiments on *slopes*, ch. ii, vol. i, p. 204, 205, I have found in the *Figure de la Terre* of Bouguer, p. cix, a passage, which shows that this astronomer, whose opinions are of such weight, considered also 36° as the inclination of a slope quite inaccessible, if the nature of the ground did not admit of forming steps with the foot.

fallible signs, that we should soon be covered by a thick fog; and lest our guides should avail themselves of this circumstance to abandon us, we obliged those who carried the most necessary instruments to precede us. We continued climbing the slopes, that lead toward the crevice of Chacaito. The familiar loquacity of the Creolian Blacks formed a striking contrast with the taciturn gravity of the Indians, who had constantly accompanied us in the Missions of Caripe. They amused themselves by laughing at those, who had been in such haste, to abandon an expedition so long preparing; and above all, they did not spare a young capuchin-monk, professor of mathematics, who never ceased to boast of the advantages of physical strength and courage, possessed by all classes of European Spaniards, over those born in Spanish America. He had provided himself with long slips of white paper, which were to be cut, and flung on the savannah, to indicate to those who strayed behind, the direction they ought to pursue. The professor had even promised the friars of his order, to fire off some rockets in order to announce to the whole town of Caraccas, that we had succeeded in an enterprise, which indeed to him alone appeared of great importance. He had forgotten that his long and heavy garments would embarrass him in the ascent. Having lost courage long before

the Creoles, he passed the rest of the day in a neighbouring plantation, gazing at us with a spying-glass directed to the Silla, as we climbed the mountain. Unfortunately for us, he had taken charge of the water and the provision so necessary in an excursion to the mountains. The slaves, who were to rejoin us, were so long detained by him, that they arrived very late, and we remained during ten hours without bread or water. This monk, who was not destitute of knowledge in natural philosophy, was murdered a few years after by the savage Indians of Apure.

The eastern is the most elevated of the two peaks, which form the summit of the mountain, and to this we directed our course with our instruments. The hollow between these two peaks has given the whole mountain the Spanish name of *Silla* (saddle). A crevice, which we have already mentioned, descends from this hollow toward the valley of Caraccas. It is nearest the western dome at it's origin. The eastern summit is accessible only by going first to the west of the crevice over the promontory of the Puerta, proceeding straight forward to the lower summit; and not turning to the east till we have almost reached the ridge, or the hollow of the Silla between the two peaks. The general aspect of the mountain points out this path; the rocks being so steep to the east of

the crevice, that it would be extremely difficult to reach the summit of the Silla, by ascending straight toward the eastern dome, instead of going by the Puerta.

From the foot of the cascade of Chacaito to one thousand toises of elevation, we found only savannahs. Two small liliaceous plants, with yellow flowers*, alone lift up their heads among the grasses, that cover the rocks. A few brambles † remind us of the form of our European plants. We in vain expected to find on the mountains of Caraccas, and subsequently on the back of the Andes, an eglantine near the brambles. We did not find one indigenous rose-tree in all South America, notwithstanding the analogy existing between the climates of the high mountains of the torrid zone, and the climate of our temperate zone. It appears, that this charming shrub is wanting in all the southern hemisphere, within and beyond the tropics. It was only on the Mexican mountains, that we were happy enough to discover, in the nineteenth degree of latitude, American eglantines ‡.

* Cypura martinicensis, and sisyrinchium *iridifolium*. This last is found also near the Venta of La Guayra at 600 toises of elevation.

† Rubus jamaicensis.

‡ Mr. Redouté, in his superb monography of rose-trees, has published our Mexican eglantine, under the name of *rosier de Montezuma*, Montezuma rose.

We were sometimes lost in the mist, and could not without difficulty find our way. At this height there is no path, and we were obliged to climb with our hands, when our feet failed us, on this steep and slippery acclivity. A vein * filled with porcelain clay attracted our attention. It is of a snowy whiteness, and no doubt the remains of a decomposed feldspar. I gave considerable portions of it to the intendant of the province. In a country where fuel is not scarce, a mixture of refractory earths may be useful, to improve the earthen ware, and even the bricks. Every time the clouds surrounded us, the thermometer sunk as low as 12° †; with a serene sky it rose to 21°. These observations were made in the shade. But it is difficult on such rapid declivities, covered with a dry, shining, yellow turf, to elude the effects of radiant caloric. We were at nine hundred and forty toises of elevation; and yet at the same height toward the east we perceived in a ravin, not merely a few solitary palm-trees, but

* The breadth of the vein is three feet, it's direction is hor. 1·2 of the compass of Freyberg, while that of the gneiss is every where hor. 3·4, with 50° or 60° of dip to the northwest. This porcelain-clay, when moistened, readily absorbs the oxygen of the atmosphere. I found, at Caraccas, the residual nitrogen very slightly mingled with carbonic acid, though the experiment was made in phials with ground glass stopples, not filled with water.

† To 9·6° R.

a whole wood. It was the *palma real;* perhaps a species of the genus oreodoxa. This group of palms, placed at so considerable an elevation, formed a striking contrast with the willows * scattered on the bottom of the more temperate valley of Caraccas. We here discovered plants of European forms, placed below those of the torrid zone.

After proceeding four hours across the savannahs, we entered into a little wood composed of shrubs and small trees, which is called *El Pejual;* no doubt because of the great abundance of the *pejoa* (gaultheria odorata), a plant with very odoriferous leaves †. The steepness of the mountain became less considerable, and we felt an indescribable pleasure in examining the plants of this region. No where perhaps can be found collected together, in so small a space of ground, productions so beautiful, and so remarkable in regard to the geography of plants. At the height of a thousand toises,

* Salix humboldtiana of Wildenouw. On the Alpine palm-trees see my *Prolegomena, de Dist. Plant.*, p. 235.

† See ch. vi, p. 83 of the present vol. The Spanish language has a great advantage in being able, like the Latin, to derive, from the name of most of the trees, a word designating an *association* or *group* of trees of the same species. Thus are formed the words *olivar, robledar,* and *pinal,* from *olivo, roble,* and *pino.* The Hispano-Americans have added tunal, pejual, guayaval, &c., places where a great many cactuses, gaultheria odortas, and psidiums, grow together.

the lofty savannahs of the hills terminate in a zone of shrubs, which by their appearance, their tortuous branches, their stiff leaves, and the dimensions and beauty of their purple flowers, remind us of what is called in the Cordilleras of the Andes the vegetation of the *paramos* and the *punas* *. We there find the family of the alpine rhododendrons, the thibaudias, the andromedas, the vacciniums, and those befarias with resinous leaves, which we have several times compared to the rhododendron of our European Alps.

Even when nature does not produce the same species in analogous climates, either in the plains of isothermal parallels †, or on table-lands the temperature of which resembles that of places nearer the poles ‡, we still remark a

* An explanation of these words has been given in vol. ii, p. 252, note.

† We may compare together either latitudes which in the same hemisphere present the same mean temperature (as, for instance, Pennsylvania and the middle of France, Chili and the southern part of New Holland); or consider the relations, that may exist between the vegetation of the two hemispheres under isothermal parallels (of the same heat).

‡ The geography of plants not only examines the analogies observed in the same hemisphere, between the vegetation of the Pyrenees and that of the Scandinavian plains; between that of the Cordilleras of Peru, and of the coasts of Chili; it discusses also the relations between the alpine plants of both hemispheres. It compares the vegetation of the Alleghanies and the Cordilleras of Mexico, with that of the

striking resemblance of appearance and physiognomy in the vegetation of the most distant countries. This phenomenon is one of the most curious in the history of organic forms. I say the history; for in vain would reason forbid man to form hypotheses on the origin of things; he is not the less tormented with these insoluble problems of the distribution of beings.

A gramen * of Switzerland grows on the granitic rocks of the Straits of Magellan. New Holland contains above forty European phanerogamous plants; and the greater number of those plants, which are found equally in the

mountains of Chili and Brazil. Remembering that every isothermal line has an *alpine branch* (that, for instance, which connects Upsal with a point in the Swiss Alps) the great problem of the analogy of vegetable forms may be reduced to the following expression; 1st, to examine in each hemisphere, and at the level of the coasts, the vegetation on the same isothermal line, especially near convex or concave summits: 2d, to compare, with respect to the form of plants, on the same isothermal line, to the north and south of the equator, the alpine branch with that traced in the plains: 3d, to compare the vegetation on homonymous isothermal lines in the two hemispheres, either in the low regions, or in the alpine regions.

* Phleum alpinum, examined by Mr. Brown. According to the investigations of this great botanist, there can be no doubt, that a certain number of plants are at once common to both hemispheres. Potentilla anserina, prunella vulgaris, scirpus mucronatus, and panicum crus galli, grow in Germany, in New Holland, and in Pennsylvania.

temperate zones of both hemispheres, are entirely wanting in the intermediary or equinoctial region, as well in the plains as on the mountains. A downy-leaved violet, which terminates in some sort the zone of the phanerogamous plants at Teneriffe, and which was long thought peculiar to that island *, is seen three hundred leagues farther north, near the snowy summit of the Pyrennees. Gramina and cyperaceous plants of Germany, Arabia, and Senegal, have been recognized among those that were gathered by Mr. Bonpland and myself on the cold table-lands of Mexico, along the burning shores of the Oroonoko, and in the southern hemisphere on the Andes of Quito †. How can we conceive the migrations of plants through countries of such a different climate, and which are now covered by the ocean? How have the germs of organic beings, which resemble each other in their appearance, and even in their internal structure, unfolded themselves at unequal distances from the poles, and the surface

* The viola cheiranthifolia, which Mr. Bonpland and I have described, (see vol. i, p. 180 and 270) has been recognized by Messrs. Kunth and Leopold von Buch among the alpine plants, which Joseph de Jussieu brought from the Pyrennees.

† Cyperus mucronatus, poa eragrostis, festuca myurus, andropogon avenaceus, lapago racemosa. See our *Nov. Gen. et Spec. Plant.*, vol. i, p. xxv, 158, 155, 189, 119.

of the seas, wherever places so distant present some analogy of temperature? Notwithstanding the influence, which the pressure of the air, and the greater or less extinction of light, exert on the vital functions of plants, it is no doubt heat, unequally distributed in different seasons of the year, that must be considered as the most powerful stimulus of vegetation.

The number of identical species in the two continents and in the two hemispheres is far less, than the assertions of the first travellers led us to believe. The lofty mountains of Equinoctial America have certainly plantains, valerians, arenarias, ranunculuses, medlars, oaks, and pines, which from their physiognomy we might confound with those of Europe; but they are all specifically different. When nature does not present the same species, she loves to repeat the same genera. Neighbouring species are often placed at enormous distances from each other, in the low regions of the temperate zone, and on the alpine heights of the equator. At other times (and the Silla of Caraccas displays a striking example of this phenomenon,) they are not the European genera, which have sent species, to people like colonists the mountains of the torrid zone; but genera of the same tribe, difficult to distinguish by their appearance, which take the place of each other in different latitudes.

The mountains of New Grenada surrounding the table-lands of Bogota are more than two hundred leagues distant from those of Caraccas, and yet the Silla, the only elevated peak in the chain of low mountains, presents these singular groupings of befaria with purple flowers, of andromedas, of gaultherias, of myrtilli, of *uvas camaronas* *, of nerteras, and of aralias with hoary leaves †, which characterize the vegetation of the paramos, on the high Cordilleras of Santa Fe. We found the same thibaudia glandulosa at the entrance of the table-land of Bogota, and in the Pejual of the Silla. The chain of the coast of Caraccas is connected, without the least doubt (by the Torito, the Palomera, Tocuyo, and the paramos of Rosas, of Bocono, and of Niquitao,) with the high Cordilleras of Merida, Pamplona, and Santa Fe; but from the Silla to Tocuyo, a distance of seventy leagues, the mountains of Caraccas are so low, that the shrubs of the family of the ericineous plants, which we have just cited, do not find the cold climate necessary for their developement.

* The name of vine-tree and *uvas camaronas* is given in the Andes to plants of the genus thibaudia, on account of their large succulent fruits. Thus the ancient botanists gave the name of bear's vine, *uva ursi*, and vine of Mount Ida, *vitis idæa*, to an arbutus and a myrtillus, which belong, like the thibaudia, to the family of the ericineæ.

† Nertera depressa, aralia *reticulata*, hedyotis *blærioides*.

Supposing even what is probable, that the thibaudias, and the rhododendron, of the Andes, or befaria, exist in the paramo of Niquitao, and in the Sierra de Merida, covered with eternal snows, these plants would nevertheless want a ridge sufficiently lofty and long for their migration toward the Silla of Caraccas.

The more we study the distribution of organized beings on the globe, the more we are inclined, if not to abandon the ideas of migration, at least to consider them as being hypotheses not entirely satisfactory. The chain of the Andes divides the whole of South America into two unequal longitudinal parts. At the foot of this chain, on the east and the west, we found a great number of plants specifically the same. The various passages of the Cordilleras no where permit the vegetable productions of the warm regions to proceed from the coasts of the Pacific Ocean to the banks of the Amazon. When a peak attains a great elevation, either in the middle of very low mountains and plains, or in the centre of an archipelago heaved up by volcanic fires, it's summit is covered with alpine plants, many of which are again found at immense distances on other mountains, that possess an analogous climate. Such are the general phenomena of the distribution of plants, which we cannot too strongly urge the natural philosopher to study. When I combat hypotheses too

easily admitted, I do not engage to substitute others more satisfactory in their place. I am rather inclined to think, that these problems cannot be solved; and that the task of the philosopher is fulfilled, when he has indicated the laws, according to which nature has distributed vegetable forms.

It is now said, that a mountain is high enough to enter into the limits of the rhododendrons, and the befarias, as it has long been said, that such a mountain reached the limit of perpetual snows. In using this expression it is tacitly admitted, that under the influence of certain temperatures certain vegetable forms must necessarily be developed. Such a supposition however, taken in all it's generality, is not strictly accurate. The pines of Mexico are wanting on the Cordilleras of Peru. The Silla of Caraccas is not covered with those oaks, which flourish in New Grenada at the same height. Identity of forms indicates an analogy in the climate; but under similar climates the species may be singularly diversified.

The charming rhododendron of the Andes, the befaria, was first described by Mr. Mutis, who observed it near Pamplona and Santa Fe de Bogota, in the fourth and seventh degree of north latitude. It was so little known before our expedition to the Silla, that it was scarcely to be found in any herbal in Europe. The

learned editors of the Flora of Peru had even described it under another name, that of acunna. In the same manner as the rhododendrons of Lapland, Caucasus, and the Alps * differ from each other, the two species of befaria we brought from the Silla † are also specifically different from that of Santa Fe and Bogota ‡. Near the equator the rhododendrons of the Andes § cover the mountains as far as the highest paramos, at sixteen and seventeen hundred toises of elevation. Advancing toward the north, on the Silla de Caraccas we find them much lower, a little below one thousand toises. The befaria recently discovered in Florida, in the latitude of 30°, grows even on hills of small elevation. Thus in a space of six hundred leagues in latitude, these shrubs descend toward the plains in proportion as their distance from the equator augments. The rhododendron of Lapland grows also at eight or nine hundred toises lower than the rhododendron of the Alps

* Rhododendrum laponicum, r. caucasicum, r. ferrugineum, and r. hirsutum.

† Befaria *glauca*, b. *ledifolia*. See our Equinoctial Plants, vol. ii, p. 118—126, plate 117—121, which contain almost a complete monography of the genus befaria, which ought to be called *bejaria*.

‡ Befaria æstuans, and b. resinosa.

§ Particularly b. æstuans of Mutis, and two new species of the southern hemisphere, which we have described under the names of b. *coarctata*, and b. *grandiflora*.

and the Pyrennees. We were surprised at not meeting with any species of befaria in the mountains of Mexico, between the rhododendrons of Santa Fe and Caraccas, and those of Florida.

In the small wood, that covers the Silla, the befaria ledifolia is only three or four feet high. The trunk is divided, even from it's root, into a great many slender and even verticillate branches. The leaves are oval, lanceolate, glaucous on their inferior part, and rolled up toward the sides. The whole plant is covered with long and viscous hairs, and emits a very agreeable resinous smell. The bees visit it's fine purple flowers; which are very abundant, as in all the alpine plants, and, when in full blossom, often near an inch wide.

The rhododendron of Switzerland, in those places where it grows between eight hundred and a thousand toises of elevation, belongs to a climate, the mean temperature of which is + 2° and — 1°, like that of the plains of Lapland. In this zone the coldest months are — 4°, and —10°: the hottest, 12° and 7°. Thermometrical observations, made at the same heights and in the same latitudes, render it probable, that at the Pejual of the Silla, one thousand toises above the Caribbean Sea, the mean temperature of the air is still 17° or 18°; and that the thermometer keeps in the coolest season between 15° and 20° in the day, and in the

night between 10° and 12°. At the hospital of St. Gothard, situate nearly on the superior limit of the rhododendron of the Alps, the maximum of heat, in the month of August, at noon, in the shade, is usually 12° or 13°; in the night, at the same season, the air is cooled by the radiation of the soil down to +1° or —1·5°. Under the same barometric pressure, consequently at the same height, but thirty degrees of latitude nearer the equator, the befaria of the Silla is often, at noon, in the sun, exposed to a heat of 23° or 24°. The greatest nocturnal refrigeration probably never exceeds 7°. We have carefully compared the climate, under the influence of which, at different latitudes, two groups of plants of the same family vegetate at equal distances from the level of the sea; the results would have been far different, had we compared zones equally distant, either from the perpetual snows, or from the isothermal line of 0° *.

In the little wood of the *Pejual*, near the purple-flowered befaria grows a heath-leaved hedyotis, eight feet high; the *caparosa* †, which

* The stratum of air, the mean temperature of which is 0°, and which scarcely coincides with the superior limit of perpetual snow, is found in the parallel of the rhododendrons of Switzerland at nine hundred toises; in the parallel of the befarias of Caraccas, at two thousand seven hundred toises of elevation.

† Vismia *caporosa*, (a loranthus clings to this plant, and appropriates to itself the yellow juice of the vismia;) davallia

is a large, arborescent hypericum; a lepidium, which appears identical with that of Virginia; and lastly, lycopodiaceous plants and mosses, which cover the rocks and roots of the trees. What gives the most celebrity in the country to this small wood is a shrub ten or fifteen feet high, of the corymbiferous family. The Creoles call it incense, *incienso* *. It's tough and crenate leaves, as well as the extremity of the branches, are covered with a white wool. It is a new species of trixis, extremely resinous, the flowers of which have the agreeable odour of storax. This smell is very different from that emitted by the leaves of the trixis terebinthinacea of the mountains of Jamaica, opposite to those of Caraccas. The people sometimes mix the *incienso* of the Silla with the flowers of the *pevetera*, another composite plant, the smell of which resembles that of the heliotropium of Peru. The *pevetera* does not, however, grow on the mountains so high as the zone of the befarias; it vegetates in the valley of Chacao, and the ladies of Caraccas prepare with it an odoriferous water extremely agreeable.

We spent a long time in examining the fine

meifolia, hieracium *Avilæ*, aralia *arborea* Jacq., and lepidium virginicum. Two new species of lycopodium, the *thyoides*, and the *aristatum*, are seen lower down toward the Puerta de la Silla. (See our *Nov. Gen. et Species Plant.*, tom. i, p. 38.)

* Trixis *nereifolia* of Mr. Bonpland.

resinous and fragrant plants of the Pejual. The sky became more and more cloudy, and the thermometer sunk below 11°, a temperature at which in this zone people begin to suffer from the cold. Quitting the little wood of alpine plants, we found ourselves again in a savannah. We climbed over a part of the western dome, in order to descend into the hollow of the Silla, a valley which separates it's two summits. We there had great difficulties to overcome, occasioned by the force of the vegetation. A botanist would not easily guess, that the thick wood covering this valley is formed by the assemblage of a plant of the musaceous family *. It is probably a maranta, or a heliconia; it's leaves are large and shining; it reaches the height of fourteen or fifteen feet, and it's succulent stalks are placed near one another like the stems of the reeds found in the humid regions of the south of Europe †. We were obliged to cut our way through this forest of musaceæ. The Negroes walked before with their cutlasses, or *machettes*. The people confound this alpine scitamineous plant with the arborescent gramina, under the name of *carice*. We saw neither it's fruit nor flowers. We are surprised to meet with a monocotyledonous family, believed to be exclusively found in the hot and low regions of the tropics, at eleven

* *Scitamineous* plants, or family of the plantains.

† Arundo donax.

hundred toises of elevation; much higher than the andromedas, the thibaudias, and the rhododendron of the Cordilleras *. In a chain of mountains no less elevated, and more northern, in the blue mountains of Jamaica, the *Heliconia of the parrots*, and the *bihai* rather grow in the alpine shaded situations †.

Wandering in this thick wood of musaceæ or arborescent plants, we constantly directed our course toward the eastern peak, which we sought to attain, and which we perceived from time to time through an opening. On a sudden we found ourselves enveloped in a thick mist; the compass alone could guide us; but in advancing toward the north, we were in danger at every step of finding ourselves on the brink of that enormous wall of rocks, which descends almost perpendicularly to the depth of six thousand feet toward the sea. We were obliged to stop. Surrounded by clouds sweeping the ground, we began to doubt whether we should reach the eastern peak before night. Happily the Negroes, who carried our water and provision, rejoined us, and we resolved to take some refreshment. Our repast did not last long. Whether the capuchin father had not thought

* Befaria.

† Heliconia psittacorum, and h. bihai. (Salisbury in the *Trans. of the Hort. Society*, vol. i, p. 273.) These two heliconias are very common in the plains of Terra Firma.

of the great number of persons who accompanied us, or the slaves had made free with our provision on the way, we found nothing but olives, and scarcely any bread. Horace, in his retreat at Tibur *, never boasted of a repast more light and frugal; but olives, which might have afforded sufficient nourishment to a poet, devoted to study, and leading a sedentary life, appeared an aliment by no means sufficiently substantial for travellers climbing mountains. We had watched the greater part of the night, and we walked for nine hours without finding a single spring. Our guides were discouraged; they wanted absolutely to go down; which Mr. Bonpland and myself had great difficulty to prevent.

In the middle of the mist I made trial of the electrometer of Volta, armed with a smoking match. Though very near a thick wood of heliconias, I obtained very sensible signs of atmospheric electricity. It often varies from positive to negative, it's intensity changing at every instant. These variations, and the conflict of several small currents of air, which divided the mist, and transformed it into clouds, the borders of which were visible, appeared to me infallible prognostics of a change in the weather. It was only two o'clock in the afternoon; we

* Carm. i, 31.

entertained some hope of reaching the eastern summit of the Silla before sunset, and of re-descending into the vale, separating the two peaks, intending there to pass the night, to light a great fire, and make our Negroes construct a hut with the large and thin leaves of heliconia. We sent off half of our servants, with orders to hasten the next morning to meet us, not with olives, but salt beef.

We had scarcely made these arrangements, when the east wind began to blow violently from the sea-side. The thermometer rose to 12·5°. It was no doubt an ascending wind, which by augmenting the temperature dissolved the vapours. In less than two minutes the clouds disappeared, and the two domes of the Silla appeared to us singularly near. We opened the barometer in the lowest part of the hollow that separates the two summits, near a little pool of very muddy water. Here, as in the West India islands *, marshy plains are found at great elevations; not because the woody mountains attract the clouds, but because they condense the vapours by the effect of nocturnal refrigeration, occasioned by the radiation of heat from the ground, and from the parenchyma of the leaves. The mercury was at 21 inches 5·7 lines. We took our course right

* Leblond, *Voy. aux Antilles*, Tom. i, p. 420.

toward the oriental summit. The obstacles of the vegetation gradually diminished; it was however necessary to cut down some heliconias; but these arborescent plants were now less thick and high. The peaks of the Silla themselves, as we have several times mentioned, are covered only with gramina, and small shrubs of befaria. Their barrenness, however, is not owing to their height. The limit of trees in this region is four hundred toises still higher; since, judging according to the analogy of other mountains, this limit would be found here only at a height of eighteen hundred toises. The absence of large trees on the two rocky summits of the Silla may be attributed to the aridity of the soil, the violence of the winds blowing from the sea, and the conflagrations so frequent in all the mountains of the equinoctial region.

In order to reach the eastern peak, which is the highest, it is necessary to approach as near as possible the great precipice, that descends toward Caravalleda and the coast. The gneiss as far as this spot had preserved it's lamellar texture, and it's primitive direction; but where we climbed the summit of the Silla, it passes into granite. It's texture becomes granular; the mica, less frequent, is more unequally spread through the rock. Instead of garnets we met with a few solitary crystals of hornblende. It

is, however, not a syenite, but rather a granite of new formation. We were three quarters of an hour in reaching the summit of the pyramid. This part of the way is not at all dangerous, provided the traveller carefully examines the stability of each fragment of rock on which he places his foot. The granite superposed on the gneiss does not present a regular separation into beds; it is divided by clefts, which often cross one another at right angles. Prismatic blocks, one foot wide and twelve long, stand out from the ground obliquely, and appear on the borders of the precipice like enormous beams suspended over the aby s.

Having arrived at the summit, we enjoyed, but only for a few minutes, all the serenity of the sky. The eye commanded a vast space of country, and looked down toward the north on the sea, and toward the south, on the fertile valley of Caraccas. The barometer was at 20 inches 7·6 lines; the thermometer at 13·7°. We were at thirteen hundred and fifty toises of elevation. We gazed on an extent of sea, the radius of which was thirty-six leagues. Those persons, whose senses are affected by looking down a considerable depth, should remain at the centre of the small flat, which crowns the eastern summit of the Silla. The mountain is not very remarkable for it's height, which is nearly eighty toises less than that of the

Canigou; but it is distinguished among all the mountains I have visited, by an enormous precipice on the side next the sea. The coast forms only a narrow border; and looking from the summit of the pyramid on the houses of Caravalleda, this wall of rocks seems by an optical illusion, of which I have already spoken, to be nearly perpendicular. The real slope of the declivity appeared to me, according to an exact calculation, 53° 28′*. The mean slope of the Peak of Teneriffe is scarcely 12° 30′. A precipice of six or seven thousand feet, like that of the Silla of Caraccas, is a phenomenon far more rare, than is generally believed by those who cross mountains without measuring their height, their bulk, and their slopes. Since the experiments on the fall of bodies, and on their deviation to the south east, have been resumed in several parts of Europe, a rock of two hundred and fifty toises of perpendicular elevation has been in vain sought for among all the Alps of Switzerland †. The declivity of Mont Blanc toward the Allèe Blanche does

* Observations of the latitude give for the horizontal distance between the foot of the mountain near Caravalleda, and the vertical line passing through it's summit, scarcely 1000 toises.

† See the testimony of a Geognost, who has visited the Alps more frequently than any other person, Mr. Escher, of Zurich, in the *Alpina*, Tom. iv, p. 291.

not even reach an angle of 45°; though in the greater number of geological works Mont Blanc is described as cut perpendicularly on the south side.

At the Silla of Caraccas, the enormous northern cliff is partly covered with vegetation, notwithstanding the extreme steepness of it's slope. Tufts of befaria and andromedas appear as if suspended from the rock. The little valley, which separates the domes toward the south, stretches toward the seaside. Alpine plants fill this hollow; and, not confined to the ridge of the mountain, follow the sinuosities of the ravin. It would seem as if torrents were concealed under that fresh foliage, and the disposition of the plants, the grouping of so many inanimate objects, give the landscape all the charm of motion and of life.

Seven months had now elapsed since we were on the summit of the Peak of Teneriffe, whence we surveyed a space of the globe equal to a fourth part of France. The apparent horizon of the sea is there six leagues farther distant* than at the top of the Silla; and yet we saw that horizon, at least for some time, very distinctly. It was strongly marked, and not confounded with the adjacent strata of air. At the Silla, which is five hundred and fifty toises

* See ch. i, vol. i, p. 105; and chap. ii, p. 183.

lower than the Peak of Teneriffe, the horizon, though nearer, remained invisible toward the north and north-north-east. Following with the eye the surface of the sea, which was smooth as glass, we were struck with the progressive diminution of the reflected light. Where the visual ray touched the last limit of that surface, the water was lost among the superposed strata of air. This appearance has something in it very extraordinary. We expect to see the horizon level with the eye; but, instead of distinguishing at this height a marked limit between the two elements, the more distant strata of water seem to be transformed into vapour, and mingled with the aërial ocean. I observed the same appearance, not in one spot of the horizon alone, but on an extent of more than a hundred and sixty degrees, near the South Sea, when I found myself for the first time on the pointed rock, that commands the crater of Pichincha; a volcano, the elevation of which exceeds that of Mont Blanc. The visibility of a very distant horizon depends, when there is no mirage, upon two distinct things; the quantity of light received on that part of the sea, where the visual ray terminates; and the extinction of the reflected light during it's passage through the intermediate strata of air. It may happen, notwithstanding the serenity of the sky and the transparency of the atmosphere

that the ocean is feebly illuminated at thirty or forty leagues distance; or that the strata of air nearest the Earth may extinguish a great deal of the light, by absorbing the rays that traverse them.

Even supposing the effects of refraction* not to exist, the islands of Tortuga, Orchila, Roques, and Aves, the nearest of which are twenty-five leagues distant, ought to be visible in fine weather from the top of the Silla. We perceived none of these islands; either because the state of the atmosphere was not favourable, or because the time we could employ in looking for them while the sky was serene was not sufficiently long. A well informed pilot, who had attempted to climb with us to the top of the mountain, Don Miguel Areche, assured us, that he had seen the Silla from the sea near the Cayes de Sal, at the *Rocca de Fuera*, in the latitude of 12° 1'†. If the surrounding mountains did not intercept the view, the coast to the east as far as the Morro de Piritoo, and to the west as far as the Punta del Soldado, ten leagues to leeward of Porto Cabello, ought to be visible from the summit of the Silla. Toward the south, within the land, the range of

* The visual ray without refraction makes an angle of 1° 39'; with a refraction of one tenth, it is 1° 50'.

† The latitude of the Silla is 10° 31' 5", according to Mr. Ferrer.

mountains, that separates Yare and the savannah of Ocumare from the valley of Caraccas, bounds the horizon like a rampart running parallel to the equator. If this rampart had an opening, a breach, as happens so often in the high mountains of Saltzburg* and Switzerland, the most stupendous scenery would thence unfold itself to our view. We should discover through that breach the Llanos or vast steppes of Calabozo; and as these steppes would reach the height of the eye of the spectator, two similar horizons of sea and land would be visible from the same point.

The rounded peak, or western dome of the Silla, concealed from us the view of the town of Caraccas; but we distinguished the nearest houses, the villages of Chacao and Petare, the coffee plantations, and the course of the Rio Guayra, a slender streak of water reflecting a silvery light. The narrow band of cultivated ground formed a pleasing contrast with the wild and gloomy aspect of the neighbouring mountains. While we take in at one view the vast landscape, we feel little regret, that the solitudes of the New World are not embellished with the images of past times. Wherever, under the torrid zone, the Earth, studded with mountains and overspread with plants, has pre-

* For example, at the *Pass Lueg.*

served it's primitive characteristics, man no longer appears as the centre of the creation. Far from taming the elements, all his efforts tend to escape from their empire. The changes made by savage nations during the lapse of ages on the surface of the globe disappear before those, that are produced in a few hours by the actions of volcanic fires, the inundations of mighty floods, and the impetuosity of tempests. It is the conflict of the elements, which characterizes in the New World the aspect of Nature. A country without population appears to the people of cultivated Europe like a city abandoned by it's inhabitants. In America, after having lived during several years in the forests of the low regions, or on the ridge of the Cordilleras; after having surveyed countries as extensive as France, containing only a small number of scattered huts; a deep solitude no longer affrights the imagination. We become accustomed to the idea of a world, that supports only plants and animals; where the savage has never uttered either the shout of joy, or the plaintive accents of sorrow.

We could not long avail ourselves of the advantage arising from the position of the Silla, commanding all the neighbouring summits. While we were examining with our glasses that part of the sea, the horizon of which was clearly terminated, and the chain of the mountains of

Ocumare, behind which begins the unknown world of the Oroonoko and Amazonia, a thick fog rose from the plains to the elevated regions. It first filled the bottom of the valley of Caraccas. The vapours, illumined from above, presented a uniform tint of a milky white. The valley appeared full of water: it seemed to be an arm of the sea, of which the adjacent mountains formed the steep shore. In vain we waited for the slave, who carried the great sextant of Ramsden. I was obliged to avail myself of the present state of the sky, and I resolved to take a few altitudes of the Sun with a sextant by Troughton of two inches radius. The disk of the Sun was half concealed by the mist. The difference of longitude between the quarter of the Trinidad and the eastern peak of the Silla appears scarcely to exceed 0° 3′ 22″ *.

While, seated on the rock, I was employed in determining the dip of the needle, I found my hands covered with a species of hairy bee, a little smaller than the honey bee of the north of Europe. These insects make their nests in the ground. They seldom fly; and, from the slowness of their movements, I should have believed they were benumbed by the cold of the mountains. The people, in these regions, call

* The difference of longitude between the Silla and La Guayra, according to Mr. Fidalgo, is 0° 6′ 40″.

them *little angels, angelitos,* because they very seldom sting. They are no doubt of the genus apis, of the division melipones. Notwithstanding the report of several travellers, it is not true, that these bees, peculiar to the New World, are destitute of all offensive weapons. Their sting is indeed weaker, and they use it less frequently*; but a person, not yet entirely persuaded of the harmlessness of these *angelitos,* can scarcely divest himself of a sensation of fear. I confess, that, during my astronomical observations, I was often on the point of letting fall my instruments, when I felt my hands and face covered with these hairy insects. Our guides assured us, that these bees attempt to defend themselves only when they are irritated by being seized by their legs. I was not tempted to try the experiment on myself.

The dip of the needle at the Silla was one centesimal degree less than in the town of Caraccas. In collecting the observations which I made during calm weather, and in very favourable circumstances, on the mountains as well as along the coast, it would at first seem, that we discover, *in that part of the Globe,* a certain influence of the heights on the dip of the needle, and the intensity of magnetical

* See a paper by Mr. Latreille, inserted in my *Observations de Zoologie*, Tom. i, p. 263 and 269.

forces; but we must remark, that the dip at Caraccas is much greater than could be supposed from the situation of the town, and that the magnetical phenomena are modified by the proximity of certain rocks*, which constitute so many particular centres, or little systems of attraction.

* I have seen fragments of quartz traversed by parallel bands of magnetic iron, carried into the valley of Caraccas by the waters descending from the Galipano and the Cerrö de Avila. This banded magnetic iron ore is found also in the Sierra Nevada of Merida. Between the two peaks of the Silla angular fragments of cellular quartz are found, covered with red oxide of iron. They do not act on the needle. This oxide is of a cinnabar red colour.

PLACES. 1800.	HEIGHT in toises.	LATITUDE North.	LONGITUDE West.	MAGNETIC DIP, new division.	OSCILLATIONS meas. the intensity of the forces.
La Guayra - - -	3	10° 36′ 19″	69° 27′	42·20°	237
Caraccas (Trinidad)	454	10° 30′ 50″	69° 25′	42·90°	232
La Venta (de Avila)	606	10° 33′ 9″	69° 28′	41·75°	234
The Silla - - -	1350	10° 31′ 15″	69° 21′	41·90°	230

The temperature of the atmosphere varied on the summit of the Silla from eleven to fourteen degrees, according as the weather was calm or windy. Every one knows how difficult it is to verify on the summit of a mountain the temperature, that must be employed in the barometric calculation. The wind was east, which seems to prove, that the breeze, or the trade-winds, extends in this latitude much higher than fifteen hundred toises. Mr. Von Buch had observed, that, at the Peak of Teneriffe, near the northern limit of the trade-winds, there exists generally at one thousand nine hundred toises of elevation a contrary current, or wind from the west. The academy of sciences had engaged the natural philosophers who accompanied the unfortunate La Perouse, to employ little air balloons in order to examine the extent of the trade-winds under the tropics at sea. Such experiments are very difficult, unless the observer quits the surface of the Earth. The little balloons do not in general reach the height of the Silla; and the light clouds, that are sometimes perceived at an elevation of three or four thousand toises, for instance, the fleecy clouds *, remain almost fixed, or have such a slow motion, that it is impossible to judge of it's direction.

* What the French call *moutons*.

During the short space of time that the sky was serene at the zenith, I found the blue of the atmosphere sensibly deeper than on the coasts. It was 26·5° of Saussure's cyanometer. At Caraccas, the same instrument generally indicated only 18° in fine and dry weather. It is probable, that, in the months of July and August, the difference of the colour of the sky on the coasts and the summit of the Silla is still more considerable *, but the meteorological phenomenon, with which Mr. Bonpland and myself were most struck during the hour we passed on the mountain, was that of the apparent dryness of the air, which seemed to increase as the fog augmented. When I took the whalebone hygrometer out of it's case, it pointed to 52° (87° Sauss.). The sky was clear; yet streams of vapours with distinct ontlines passed from time to time in the midst of us, sweeping the ground. Deluc's hygrometer went back to 49° (85° Sauss.). Half an hour later, a thick cloud surrounded us; we could no longer perceive the objects that were the nearest to us, and we saw with surprise, that the instrument continued retrograding toward dryness as low as 47·7° (84° Sauss.). The temperature of theair in the mean time was from 12° to 13°. Though in the whalebone hygrometer the

* See, chap. ii, vol, i, p. 188; and chap. iii, vol. ii, p. 95.

point of saturation in the air is not at 100°, but at 84·5° (99° Sauss.), this effect of a cloud on the instrument appeared to me very extraordinary. The mist lasted long enough for the whalebone to have increased it's length by it's attraction of the particles of water. Our clothes were not wet. A traveller, accustomed to observations of this kind, lately assured me, that he had remarked on Mount Pélée in Martinico a similar effect of clouds on the hair hygrometer. It is the duty of the natural philosopher, to relate all the phenomena that Nature displays to him, especially when he has neglected nothing to avoid error in his observations. Mr. de Saussure, in a violent shower, saw his hygrometer, which was not wetted by the rain, keep up * (almost as at the Silla in the cloud) at 84·7° (48·6° Deluc); but it is easier to conceive, that the air dispersed between the drops of rain is not completely saturated, than to explain how vesicular vapours, in immediate contact with the hygroscopic body, do not impart to it greater humidity. What can be the state of a vapour, which does not wet, and which is visible to the eye? We must, I believe, suppose that a much drier air had been mixed with that where the cloud was formed; and that the vesicles of vapour, the volume of which is much

* See chap. iv, vol. ii, p. 93.

less considerable than that of the interposed air, did not wet the smooth surface of the slip of whalebone. The transparent air, which precedes a cloud, may sometimes be more humid than the current of air which comes with the cloud.

It would have been imprudent to remain longer in this thick fog, on the edge of a precipice of seven or eight thousand feet deep*. We descended the eastern dome of the Silla, and gathered in our descent a gramen, that not only forms a new and very remarkable genus, but which to our great astonishment we found again some time after on the summit of the volcano of Pichincha, at four hundred leagues distance from the Silla in the southern hemisphere †. The lichen floridus, so common in the north of Europe, covered the branches of the befaria and the gaultheria odorata, descending even to the roots of these shrubs. Examining the mosses, which cover the rocks of gneiss in the valley between the two peaks, I was surprised at finding real peb-

* Toward the north west the slopes appear more accessible. I have even heard of a path frequented by the smugglers, which leads to Caravalleda between the two peaks of the Silla. From the eastern peak I took the bearings of the western peak, S. 64° 40′ W.; and of the houses, which I was told belonged to Caravalleda, N. 55° 20′ W.

† *Aegopogon cenchroides.* See our *Nov. Gen. et Species*, vol. i, p. 132, Tab. xlii.

bles, rounded fragments of quartz *. It may be conceived, that the valley of Caraccas was once an inland lake, before the Rio Guayra had found an issue to the east near Caurimare, at the foot of the hill of Auyamas ; and before the existence of the ravin of Tipe on the west, toward Catia and Cape Blanco. But how can we imagine, that these waters could ascend as high as the Silla, when the mountains opposite this peak, those of Ocumare, were too low to prevent their gushing out into the Llanos? The pebbles could not have been brought by the torrents from more elevated points, since there is no height that commands the Silla. Must we admit, that they have been raised up, like all the mountains, which border the coast?

It was half after four in the evening when we finished our observations. Satisfied with the success of our journey, we forgot that there might be danger in descending in the dark steep declivities covered by a smooth and slippery turf. The mist concealed the valley from us ; but we distinguished the double hill of La Puerta, which, like all objects placed almost perpendicularly beneath the eye, appeared extraordinarily near. We relinquished our design of passing the night between the two summits

* Fragments of brown copper ore were found mixed with these pebbles at an elevation of 1170 toises.

of the Silla, and having again found the path we had cut through the thick wood of heliconias, we arrived at the Pejual, the región of odoriferous and resinous plants. The beauty of the befarias, and their branches covered with large purple flowers, again attracted all our attention. When in these climates we gather plants to form our herbals, we become difficult in our choice in proportion to the luxury of vegetation. We cast away the branches we have first cut, because they appear less beautiful than those we could not reach. Overloaded with plants in quitting the wood, we still regret not having made a more ample harvest. We tarried so long in the Pejual, that night surprised us as we entered the savannah, at more than nine hundred toises of elevation.

As twilight scarcely exists between the tropics, we pass suddenly from bright daylight to darkness. The moon was on the horizon; but her disk was veiled from time to time by thick clouds, hurried on by a cold and impetuous wind. The steep declivities, covered with yellow and dry herbs, now appeared in shade; and now, suddenly illumined, seemed like precipices, the depth of which the eye sought to measure. We proceeded in a long line, and endeavoured to assist ourselves by our hands, that we might not roll down by falling. The guides, who carried our instruments, abandoned

us successively, to sleep in the mountain. Among those who remained I admired the address of a Congo Black, who, bearing on his head a large dipping needle, held it constantly steady, notwithstanding the extreme declivity of the rocks. The fog had disappeared by degrees in the bottom of the valley; and the scattered lights we perceived below us caused a double illusion. The steeps appeared still more dangerous than they really were; and, during six hours of continual descent, we thought ourselves equally near the farms at the foot of the Silla. We heard very distinctly the voices of men, and the shrill notes of the guitars. Sound is generally so well propagated from below upward, that in a balloon at three thousand toises of elevation the barking of dogs is sometimes heard *.

We did not arrive till ten at night at the bottom of the valley, overcome with fatigue and thirst. We had walked for fifteen hours, nearly without stopping; the soles of our feet were made sore by the asperities of a rocky soil, and the hard and dry stalks of the grapes. We had been obliged to pull off our boots, the soles having become too slippery. On declivities destitute of shrubs, or ligneous herbs, which may be grasped by the hand, the danger of the descent is diminished by walking barefoot. In

* Mr. Gay-Lussac in his ascent on the 15th of September 1805.

order to shorten the way, our guides led us from the Puerta de la Silla to the farm of Gallegos by a path, which conducted us to a reservoir of water, *el tanque*. They missed their way, however; and this last descent, the steepest of all, brought us near the ravin of Chacaito. The noise of the cascades gave this nocturnal scene a grand and wild character.

We passed the night at the foot of the Silla. Our friends at Caraccas were able to distinguish us with glasses on the summit of the eastern peak. They felt an interest in the history of our fatigues, but they were little satisfied with the result of a measurement, which did not give the Silla even the elevation of the highest summit of the Pyrennees *. How can we blame that national feeling, which attaches itself to monuments of nature, in a spot where the monuments of art are nothing? How can we wonder, that the inhabitants of Quito and Rio Bamba, proud for ages of the height of Chimborazo, mistrust those measurements, that elevate the mountains of Himalaya in India above all the colossal Cordilleras?

During the journey to the Silla, which I have just described, and in all our excursions in the valley of Caraccas, we were very attentive to

* It was formerly believed, that the height of the Silla of Caraccas scarcely differed from that of the peak of Teneriffe. *Laet. Americæ Descr.*, 1633, p. 682.

the lodes and indications of ores, which we found in the mountains of gneiss. No regular trials having been made, we could only examine the fissures, the ravins, and the fallings down of the earth occasioned by the torrents in the rainy season. The rock of gneiss, passing sometimes * into a granite of new formation, sometimes mica-slate, belongs in Germany to the most metalliferous rocks; but in the New Continent, the gneiss has not hitherto been remarked as very rich in ores worth working. The most celebrated mines of Mexico and Peru are found in the primitive and transition schistus, in the trap porphyries, the grauwakke, and the alpine limestone †. In several spots of the valley of Caraccas, the gneiss contains a small quantity of gold, disseminated in small veins of quartz, sulphuretted silver, azure copper ore, and galena; but it remains doubtful, whether these different metalliferous substances are not too poor, to merit any attempt at working them. Attempts indeed were made at the conquest of the province, toward the middle of the sixteenth century.

From the promontory of Paria to beyond Cape Vela, navigators had found ornaments of gold, and gold dust, among the inhabitants of the coast. They penetrated into the interior of the

* Especially at great elevations.

† *Nouv. Esp.* vol. ii, p. 494.

country, to discover whence the precious metal came ; and though the information obtained in the province of Coro, and the markets of Curiana and Cauchieto*, had clearly shown, that real mineral wealth was to be found only to the west and south-west of Coro, that is to say, in the mountains which lie near those of New Grenada, the whole province of Caraccas was not the less eagerly explored. A governor recently arrived on that coast could recommend himself to his court only by boasting of the mines of his province ! and in order to take from cupidity what was most ignoble and repulsive, the thirst of gold was justified by the manner, in which it was pretended that riches acquired by fraud and violence were employed. " Gold," says Christopher Columbus, in his last letter † to King

* Petr. Martyr, *Ocean.* Dec. i, lib. viii, p. 90, 91. Grynæus, p. 83, 84. Fray Pedro Simon, *Not.* ii, cap. i, N° 3, p. 55. Herrera, Dec. i, lib. iv, cap. v (vol. i, p. 106). The Spaniards found in 1500 in the country of Curiana (now Coro) little birds, frogs, and other ornaments of gold. Those who had cast these figures lived at Cauchieto, a place nearer the Rio la Hacha. I have seen ornaments resembling those described by Peter Martyr of Anghiera, whch indicate tolerably skilful goldsmiths, among the works of the ancient inhabitants of Cundinamarca. The same industry appears to have prevailed on the coasts, and farther to the south, in the mountains of New Grenada.

† *Lettera rarissima data nelle Indie nella isola di Jamaica a 7 Julio del* 1503. (Bassano, 1810, p. 29—31.) "Lo oro e

Ferdinand, "gold is a thing so much the more necessary to your majesty, because, in order to fulfil the ancient prediction, Jerusalem is to be rebuilt by a prince of the Spanish monarchy. Gold is the most excellent of metals. What becomes of those precious stones, which are sought for at the extremities of the globe? They are sold, and are finally converted into gold. With gold we not only do whatever we please in this world, but we can even employ it to snatch souls from Purgatory, and to people Paradise." These words, of such simple candour, bear the stamp of the age in which Columbus lived; but we are surprised to see the most pompous eulogium of riches written by a man, whose whole life was marked by the most noble disinterestedness.

The conquest of the province of Venezuela having begun at it's western extremity, the neighbouring mountains of Coro, Tocuyo, and Barquisimeto, first attracted the attention of the *Conquistadores*. These mountains join the Cordilleras of New Grenada (those of Santa Fe, Pamplona, La Grita, and Merida) to the littoral chain of Caraccas. It is a land so much the more interesting to the geognost, as no map has yet made known the mountainous ramifica-

metallo sopra gli altri excellentissimo, e dell' oro si fanno li tesori e chi lo tiene fa e opera quanto vuole nel mondo, e finalmente aggionge a mandare le anime al Paradiso."

tions, which the paramos of Niquitao and Las Rosas, the last of those the height of which reaches sixteen hundred toises, send out toward the north-east. Between Tocuyo, Araure, and Barquisimeto, rises the group of the Altar-mountains, connected toward the south-east with the paramo of Las Rosas. A branch of the Altar stretches to the north-east by San Felipe el Fuerte, joining the granitic mountains of the coast near Porto Cabello. The other branch is directed to the east toward Nirgua and Tinaco, and joins the chain of the interior, that of Yusma, Villa de Cura, and Sabana de Ocumare.

The whole land we have been describing separates the waters which flow to the Oroonoko from those which run into the immense lake of Maracaybo, and the Caribbean Sea. It presents rather temperate than hot climates; and it is looked upon in the country, notwithstanding the distance of more than a hundred leagues, as a prolongation of the metalliferous soil of Pamplona. It was in the group of the western mountains of Venezuela, that the Spaniards, in the year 1551, wrought the gold mine of Buria *, which was the cause of the foundation of the town of Barquisimeto †. But these works, like many other mines successively opened, were

* *Real de Minas de San Felipe de Buria.*

† *Nueva Segovia.*

soon abandoned. Here, as in all the mountains of Venezuela, the ore has been found to be very variable in it's produce. The *lodes* are very often divided, or cease; and the metals appear only in kidney-ores, and present the most delusive appearances. It is however only in this group of mountains of San Felipe and Barquisimeto, that the working of mines has been continued till our days. Those of Aroa, near San Felipe el Fuerte, situate in the centre of a very feverish country, are the only mines which are wrought in the whole Capitania-General of Caraccas. They yield a small quantity of copper, and we shall speak of them after we have surveyed the fine valleys of Aragua, and the banks of the lake of Valencia.

Next to the works at Buria, near Barquisimeto, those of the valley of Caraccas, and of the mountains near the capital, are the most ancient. Francisco Faxardo and his wife Isabella, of the nation of the Guaiqueries, both founders of the town of Collado *, often visited the table-land, where the capital of Venezuela is now situate. They had given this table-land the name of *Valle de San Francisco*; and having seen some bits of gold in the hands of the natives, Faxardo succeeded, in the year

* Caravalleda.

1560, in discovering the mines of *Los Teques* *, to the south-west of Caraccas, near the group of the mountain of Cocuiza, which separate the valleys of Caraccas and Aragua. It is thought, that in the first of these valleys, near Baruta (to the south of the village of Valle), the natives had made some excavations in veins of auriferous quartz; and that, when the Spaniards first settled there, and founded the town of Caraccas, they filled the shafts which had been dry, with water. It is now impossible to verify this fact; but it is certain, that, long before the Conquest, grains of gold were a medium of exchange, I do not say generally, but among certain nations of the New Continent †. They gave gold to purchase pearls; and it does not appear extraordinary, that, after having for a long time picked up grains of gold in the rivulets, nations enjoying fixed habitations, and de-

* Thirteen years later, in 1573, Gabriel de Avila, one of the alcades of the new town of Caraccas, began anew the working of these mines, which were from that time called the *Real de Minas de Nuestra Senora*. Perhaps this same Avila, on account of a few farms which he possessed in the mountains adjacent to La Guayra and Caraccas, has occasioned the Cumbre to receive the name of *Montana de Avila*. This name has subsequently been applied erroneously to the Silla, and to all the chain which extends toward Cape Codera. Oviedo, p. 298 and 324.

† Petrus Martyr, p. 91.

voted to agriculture, should have tried to follow the auriferous veins, in the superior surface of the soil. The mines of *Los Teques* could not be peaceably wrought, till the defeat of the Cacique, Guaycaypuro, a celebrated chief of the Teques, who so long contested with the Spaniards the possession of the province of Venezuela.

We have yet to mention a third point, to which the attention of the Conquistadores was called by indications of mines, so early as the end of the 16th century. In following the valley of Caraccas to the east beyond Caurimare, in the road to Caucagua, we reach a mountainous and woody country, where a great quantity of charcoal is now made, and which anciently bore the name of the Province of *Los Mariches.* In these eastern mountains of Venezuela, the gneiss passes into a talcous state. It contains, as at Salzbourg, lodes of auriferous quartz. The labours very anciently begun in those mines have often been abandoned and resumed.

The mines of Caraccas remained forgotten during more than a hundred years. But in the times nearest our own, toward the end of the last century, an intendant of Venezuela, Don Jose Avalo, again gave into the illusions, which had flattered the cupidity of the Conquistadores. He fancied, that all the mountains near the capital contained great metallic riches. A

young viceroy of New Spain, Count Galvez, visiting at this period the coast of Terra Firma, to examine it's fortifications, and state of defence, was requested by the intendant, to send him some Mexican miners. The choice was not fortunate; they who were employed could not distinguish a single rock; every thing, even mica, appeared to them gold and silver. The two chiefs * of these Mexican miners were allowed fifteen thousand francs a year; and it was not their interest, to discourage a government, which was afraid of no expense, that was intended to promote the working of the mines. Their operations were directed toward the ravin of Tipe, and the ancient mines of Baruta to the south of Caraccas, where the Indians gathered even in my time a little stream gold. The zeal of the administration soon diminished; and after having incurred many useless expenses, the enterprise of the mines of Caraccas was totally abandoned. A small quantity of auriferous pyrites, sulphuretted silver, and a little native gold, had been found; but these were only feeble indications, and in a country where labour is extremely dear, there was no inducement to pursue works so little productive.

We visited the ravin of Tipe, situate in that

* Pedro Mendana and Antonio Henriquez.

part of the valley, which opens toward Cape Blanco. In going from Caraccas, we pass near the great barracks of San Carlos over a barren and rocky soil. Scarcely a few plants of argemone mexicana are to be found. The gneiss appears every where above ground. We might have fancied ourselves on the table-land of Freiberg. We crossed first the little rivulet of *Agua Salud*, a limpid water, which has no mineral taste, and then the Rio Caraguata*. The road is commanded on the right by the Cerro de Avila and the Cumbre ; and on the left, by the mountains of *Aguas Negras.* This defile is very interesting in a geological point of view ; at this spot the valley of Caraccas communicates by the vallies of Tacagua and of Tipe with the coast near Catia. A ridge of rock, the summit of which is forty toises above the bottom of the valley of Caraccas, and more than three hundred toises above the valley of Tacagua, divides the waters which flow into the Rio Guayra and toward Cape Blanco. On this point of division, at the entrance of the branch, the view is highly pleasing. The climate changes as we descend toward the west. In the valley of Tacagua we found some new habitations, *conucos* of maize and plantains. A very extensive plantation of tu-

* Gneiss, hor. 12, dip 70° west.

na, or cactus, stamps a peculiar character on this barren country. The cactuses reach the height of fifteen feet, and grow in the form of candelabras, like the euphorbiums of Africa. They are cultivated in order to sell their refreshing fruits in the market of Caraccas. The variety destitute of thorns is called, whimsically enough, in the colonies, *tuna de Espana.* We measured at the same place magueys, or agaves, the long stem of which, loaded with flowers, was forty-four feet high. However common this plant is become in the south of Europe, a person born in a northern climate is never wearied of admiring the luxury of vegetation, the rapid developement of a liliaceous plant, which contains at once a sweet juice, and astringent and caustic liquids, employed in the cure of wounds to consume proud flesh.

We found several veins of quartz in the valley of Tipe appearing above the soil. They contained pyrites, carbonated iron ore, traces of sulphuretted silver *(glasserz)*, and gray copper ore, or fahlerz. The works which had been undertaken, either to extract the ore, or to explore the nature of it's bed, appeared to be very superficial. The earth falling in had filled up those excavations, and we could not judge ourselves of the richness of the lode. Notwithstanding the expense incurred under the intendancy of Don Jose Avalo, the great

question, whether the province of Venezuela contains mines rich enough to be wrought, is yet problematical. Though in countries where hands are wanting, the culture of the soil demands unquestionably the first care of government, yet the example of New Spain is sufficient to prove, that the working of metals is not always unfavourable to the progress of agriculture. The best cultivated Mexican fields, those which recall to the memory of the traveller the most beautiful parts of France and the south of Germany, extend from Silao toward the Villa of Leon: they are in the neighbourhood of the mines of Guanaxuato, which alone furnish a sixth part of all the silver of the New World.

NOTES TO THE FOURTH BOOK.

NOTE A.

The end of the eclipse of the Sun, on the 28th of October, 1799 (Chapter X, p. 312 of this volume), presented me with a very remarkable phenomenon, which I shall describe, as I find it noted in my Astronomical Journal. "Looking through Dollond's large achromatic telescope very steadfastly (at $4^h\ 58'$ by the chronometer) at the darkened part of the Sun's disk, I saw three or four luminous dots, appear and disappear successively. They were like stars of the fifth magnitude. I thought for some moments, that this phenomenon was owing to the explosion of volcanoes in the moon, the existence of which is admitted by Herschell, but which Don Antonio Ulloa considers as holes, that pass through the planet. What was my astonishment, when, toward the end of the eclipse, at $5^h\ 37'$ by the chronometer, I perceived two similar luminous dots beyond the disk, at an arc of twelve or fifteen minutes distance from the limb which had not been eclipsed! The eclipse ended at $5^h\ 48'\ 37''$ by the chronometer. These two luminous dots appeared only once. Their light was of the intensity of a star of the third magnitude. I could not explain to myself this appearance. My eye was not at all fatigued."

Louville relates (*Mem. de l'Acad.*, 1715, p. 96) having seen at London, during the total eclipse of the Sun on the 3d of May 1715, "fulminations, or instantaneous vibrations of luminous rays. They appeared, during the total darkness, on the surface of the moon, so that I thought I saw trains of

gunpowder fired. Considering that the moon has a great many mountains, it is not astonishing that it should be subject to very frequent storms." In what I observed there was no *fulguration*, or appearance of trains of luminous matter. They were spots of a steady light, which disappeared after having shone six or eight seconds. They were not reddish, like those Ulloa believed to be the effect of an excavation in the moon. (*Phil. Trans.*, 1779, p. 116. *Mém. de Berlin*, 1788, p. 204.) To what cause must we refer these luminous appearances, observed at different times on the lunar disk, during an eclipse of the Sun? The spots that I remarked beyond the solar disk could not be owing to the same optical illusion, that has made some observers believe they saw a satellite of Venus, in which a few even imagined they perceived *phases*.

NOTE B.

I shall here insert the satisfactory and ingenious explanation, that Mr. Arago has given of the phenomenon of twinkling, and which has not yet been made public. The following is the note, that this learned philosopher had the kindness to write for me.

"The natural philosophers and astronomers, who have turned their attention to the *twinkling* of the stars, have almost all neglected the most remarkable circumstance, perhaps, of the phenomenon. I mean the sudden and frequent changes of colour, by which it is constantly accompanied. The progress, which the physical theory of light has made within these few years, will enable us, I believe, to connect the explanation of this curious fact with the law of *interferences*, discovered by Dr. Young.

"According to the experiments of this illustrious philoso-

pher, two rays of homogeneous light, arriving at the same point of space by two ways little different, add or neutralize themselves, according as the difference of the two ways has this, or that value. The differences, which accord with the neutralization of rays of different tints are so sensibly unequal, that the result of the *interference*, or mixture of two *white* pencils of light, should always be accompanied by a manifest coloration. Experience has moreover shown us (see *Annales de Chimie et de Physique*, tom. i, p. 199), that, in seeking the place where two pencils are capable of influencing each other, it is not sufficient to consider merely the difference of the ways they have traversed; but it is necessary also to attend to the unequal refractive powers of the mediums they have traversed. This admitted, it is easy to demonstrate, that the rays emitted from the same place, collected in the focus of a small lens, vibrate in concert, or unite together, if they have all traversed mediums of the same density, or equal refractive power; and the same mode of reasoning shows, that, on the contrary, an unequal refractive power must, according as we suppose it more or less considerable, occasion, in the same focus, the neutralization of some class or other of coloured rays. If we apply these considerations to the twinkling of stars, we shall find that, if all the rays of light, which arrive at the different parts of the pupil, constantly traverse atmospheric strata of equal density, the image of the star will always be equally intense, and of the same colour; while in the contrary supposition, it's colour and brilliancy may vary every instant. The chances of twinkling will be much less numerous for a star at the zenith, under the same circumstances, than for one but little above the horizon. In our climates they will be less than under the tropics, where heat is more uniformly distributed in the strata of the atmosphere. The variations of intensity will be more easily perceived in stars of the first magnitude, where they will be attended with a change of colour more striking than in small stars; and in white stars,

than in those which are naturally coloured. All these circumstances, if I be not mistaken, agree with observation."

NOTE C.

In following the method I have indicated (Chap. X, p. 328 of the present volume) for estimating the intensity of the light of the stars, there is no reason to fear, that a change of inclination in the mirrors should have any sensible influence on the quantity of light reflected. This influence is, without doubt, considerable, when light is reflected by a transparent glass; but it is almost null, when the rays are reflected by a glass silvered on the back. Hence it follows, that, in order to compare two stars, and equalize their light, we can bring into the field of the telescope such as are at very considerable angular distances. The following are the results of my investigations, placing on the *astrometer* stars of the first magnitude, between 80° and 100°; those of the second magnitude, between 60° and 80°; those of the third, between 45° and 60°; those of the fourth, between 30° and 45°; and those of the fifth, between 20° and 30°.

Sirius - - - -	100°
Canopus - - -	98
α Centauri - - - -	96
Achernar - - -	94
β Centauri - - -	93
Fomalhaut - - -	92
Rigel - - - -	90
Procyon - - -	88
Betelgueuse - -	86
ε Canis majoris - -	83
δ - - - - - - -	81
α Gruis - - - -	81

α Pavonis - - - - -	78°	
β Gruis - - - - -	75	
β Canis majoris - -	73	
α Leporis - - - -	71	
α Ramphasti - - -	70	
β Leporis - - - -	70	
α Columbæ - - -	68	
β - - - - - - - -	67	
η Canis majoris - -	66	
α Phœnicis - - -	65	
γ Gruis - - - - -	58	
ζ Canis majoris - -	51	Z.
α in the Indian - -	50	
ϵ Canis majoris - -	47	

It is more difficult to determine whether α in the Indian have half the light of Sirius, than to recognize whether α in the Crane be nearer the brilliancy of Sirius than that of α in the Indian. Comparing Betelgueuse and α in the Peacock to α in the Crane, we find, that Betelgueuse must be placed between α of the Crane and Sirius, and α of the Peacock between α in the Crane, and α in the Indian. The narrower the limits, the more easy it is to avoid mistakes; especially if we try to arrive at the same numerical result by two different ways. For example, α in the Crane and Procyon may be compared either directly: or by equalizing with a reflecting instrument the light of Procyon and Canopus, and of Canopus and of α in the Crane; or lastly, by comparing α in the Crane and Procyon through the intermedium of Rigel and Sirius. Herschell classes the stars of the Great Dog in the following order, α, ϵ, β, δ, η. In the Crane there is at present much less difference between α and β than between β and γ. Respecting the relative intensity of the light of Sirius and Canopus, the opinions of astronomers who have visited the equinoxial zone have been singularly divided. I believe I have determined by a great many

combinations, that Sirius is as much brighter than Canopus, as α Centauri is brighter than Achernar. I hope to be able to pursue these investigations.

NOTE D.

The following is an extract of the observations on the mirage, made in 1799 and 1800, during my stay at Cumana, as I noted them in my Astronomical Journal. I could not at that time be acquainted with the theory of Mr. Monge, and the experiments of Messrs. Brandes, Wollaston, and Tralles. Those of the celebrated English philosopher were made at the same period as mine. Mr. Vince contented himself with following with his telescope the phenomena of supension, without determining the magnitude of the images, and the depression of the horizon of the sea. These determinations were also wanting in the researches of Mr. Buesch at Hamburg *(Tractatus duo optici argumenti)*; and of the Abbé Gruber *(Ueber Stralenbrechung und Abprallung des Lichts,* 1793). Though in 1800 I had only a vague idea of the different circumstances, which modify the mirage, I did not neglect to measure the angles of depression of the horizon, the breadth of the interval between the horizon and the suspended object, the temperature of the sand, above the surface of which the rays of light passed, and that of the air and of the water. I examined the influence of the figure of the small islands on their more or less complete suspension; the circumstances where the suspension takes place without double images; and at length the changes, which the rising or setting sun occasions in the appearances of these extraordinary refractions. (See vol. ii, p. 196; and chap. xi, p. 358 of the present vol.)

" Cumana, lat. 10° 27′ 52″. Terrace of the house of Don Pasquel Martinez, which I have inhabited since my return

from the Rio Negro. I discern from it the same objects, as I perceived from my former dwelling, near the Rio Manzanares. I see on the south the mountains of the Brigantine, the Tataraqual, and the whole chain of the mountains of New Andalusia; on the north-west, the group of islands lying between the ports of Cumana and Nueva Barcelona, the Caraccas Islands, Picuita, and Boracha. Distance of these islands from ten to fifteen miles. Bird's quadrant with a double division, carefully verified by a spirit level and plumbline. The instrument is placed on a thick wall. I constantly employed the division into 96°; every degree of which is equal to 56′ 15″. The vernier subdivides the degrees into 120 parts. The error of collimation was determined by the latitude of the place, and by comparison with a sextant of Ramsden's. It amounts to 8′ 40″ (sexag. div.) to be added to the zenith distances. The object-glass of the quadrant is 124 feet 11 inches above the level of the sea. In order to be more certain, that no accident influences the angles of depression and of suspension, I measure every time the angle of altitude of a tower (A), which from it's elevation and proximity cannot be sensibly affected by the changes in the horizontal refractions.

" The first of September, 1800, at 23h 10′, the points of the islands, and capes of the neighbouring continent, all appear elevated, suspended. Dollond's telescope, magnifying 65 times. Therm. in the open air, in the shade, 22·6° R.; Deluc's hygrometer, 45·2°; cyanometer, 20°; A (or tower serving as a rectification of the instrument), 94° 31′ 3″; B, or eastern cape of the island of Caraccas, 95° 52′ 25″; C, or summit of the small island Picuita, 95° 56′ 30″; D, or base of the island Picuita, 95° 58′ 23″; E, or height of the island of Boracha, 95° 46′; F, or depression of the horizon of the sea, 95° 58′ 30″. The sea water, 21·4°; the sand of the plains between the town and sea, 30·8° R.

" The third of September, 19h in the morning. Therm. 21° R. Hyg. 43°. Cyan. 14°.

A 94° 31′
B 95° 51′ 45″
C 95° 55′ 24″
D 95° 58′ 21″
E 95° 46′
F 95° 59′

"In the evening at six; cloudy sky; it is going to rain. The air extremely transparent. The islands appear much nearer. Therm. 21·7° R. Hyg. 49·2°.

D 95° 55′ 30″
E 95° 46′ 15″

"The fourth of September, at $5\frac{1}{4}$h, cloudy; air very transparent. Therm. 22·5°. Hyg. 41·2°. The water of the sea at it's surface 21·8°. White sand on the shore, 28·5°.

A 94° 31′ 6″
B 95° 52′ 15″
C 9.° 55′ 39″
D 95° 58′ 6″
E 95° 46′ 15″
F 95° 58′

"All the capes suspended, but the suspended part is only five or six minutes in length. Picuita is entirely in the air, it's apparent length 0° 11′ 5″. At sunset, the interval between the base of the island and the horizon of the sea diminishes, as the atmosphere gets darker. When the disk of the Sun is hidden behind very dark clouds, the centre of Picuita rests on the horizon; the extremities of the island are then alone suspended. The Sun reappears in all it's splendour, though only at an altitude of four degrees, and the whole of the island is elevated again; it is entirely suspended, as well at it's centre, which forms a small convexity, as at it's two extremities. No double image, only suspension. After the setting of the Sun, Picuita is still suspend-

ed. I examine it with Dollond's large telescope. It is already so dark, that I cannot without some difficulty read the divisions on the limb of the instrument. The ground is no doubt getting colder; but I still perceive air (an aërial space) between the depressed horizon of the sea and the base of the island.

" The fifth of September. During the morning twilight. Therm. 21·3°. Hygr. 45·2°. The Sun's disk not yet visible, and already the whole of Picuita appears suspended in the air. Twilight very feeble. (In what follows I have inserted after the degrees the hundred and twentieth parts, as they appeared on the quadrant.)

A 94° 62
B 95° 103·7
C 95° 111·2
D 95° 115·9
E 95° 93
F 95° 117·7

" Three in the afternoon. Therm. 23·2° R. Hyg. 36·2° Deluc. Cyan. 22°.

B 95° 105·3
C 95° 112·7
D 95° 117·5
E 95° 93
F 95° 117·5

" Six in the afternoon. The Sun is only four degrees high. Therm. 22·8° R. Hyg. 36·5°.

A 94° 62·2
B 95° 104·5
C 95° 111·3
D 95° 116
E 95° 92·7
F 95° 116·3

" During the setting of the Sun, the horizon is oscillating. Picuita sinks, and is no longer suspended. The depression

of the horizon, at the moment of the sun's setting, 95° 115·7; and twelve minutes after, during the twilight, 95° 114·7. C, or Picuita, 95° 112. Still later, C, 95° 111·3. F 95° 116·3. There can be no error in these observations, for the signal A remains at the same height, while the horizon of the sea undergoes such rapid changes. On other days, I have seen the small islands rest on the horizon a little before the setting of the sun. The setting does not always occasion the same change of temperature, and of the terrestrial refractions.

"The 24th of September. Since the 18th, sky constantly cloudy. The weather changes in the night of the 23d. Great transparency, the stars very brilliant, but no twinkling, even at the horizon. The 24th great dryness. Hyg. at 21^h morning, 32° Deluc (67 Sauss.). Therm. 21·5° Reaum. Depression of the horizon, the greatest I ever observed. Water of the sea, 22°. The arid soil of the shore, 32·7°. Boracha is entirely in the air. The sky very blue. Cyan. 21. Small fishing-boats suspended, swimming in the air, three or four minutes above the horizon of the sea, which is extremely well defined. One of the boats, viewed through the telescope, presents an inverted image.

A	94°	62	
B	95°	106	
C	95°	116·2	
E	95°	93·2	
F	96°	12,	consequently near 8′ greater than on the 4th of September.

"Picuita appears often double, and inverted during the remainder of the day. The inverted image is as large and as high as the direct image. This last is entirely suspended; but the inverted image, the intensity of the light of which is very weak, trenches on the horizon of the sea: it covers a portion of the last strata of the ocean. At 22^h in the morning, therm. 23·5°; hyg. 31·5°.

A 94° 62·3
C 95° 112
F 96° 0

" At noon the depression of the horizon is still 96° 1. Dead calm.

" On the 25th and 26th of September, the horizon, shining with light, oscillating three or four times in the space of an hour. The depression of the horizon is sometimes 95° 118, sometimes 96° 4, without any change in the meteorological instruments, in the place where Bird's quadrant is. The changes no doubt take place in the intermediary strata of air, and in the temperature of the water and of the ground, which radiate heat. I think I perceive, that the changes of depression are announced by a variation of colour. Without any alteration in the azure colour of the sky, the horizon of the sea separates into two bands. I see a streak of a deeper colour than the rest; all that is farther off than this streak grows paler, and at length completely disappears; and all that is nearer than the streak acquires a deeper colour. The island of Picuita is already suspended. It's foot (it's inferior limit) does not change; but progressively, as the streak becomes the horizon, and as that part of the sea behind the streak disappears, the apparent suspension of the island augments. It seems to retire farther off from the horizon; while it is rather the horizon, that has retired from the island. Before the formation of the streak: D. 95° 116·3; F. 95° 119. A quarter of an hour later, after the zone behind the streak has become invisible, I find D. 95° 116·3, F. 96° 4·8. By degrees the anterior zone, which forms the horizon, grows paler in it's turn, and the portion of sea behind the streak reappears. You would say, that this gains in colour what the other loses. F. is again 95° 118. D. remains invariably 95° 116·5. The part which has reappeared acquires a deep blue tint: the nearer part, on the contrary (that which formed the horizon, when the depression

was 95°119) is quite white. I have observed this oscillation for several days. The variations of colour are the prognostics of a change in the depression. Ought we not to admit, that the luminous rays sent to us by the most distant part of the sea, that which grows paler, are inflected in such a manner, during their passage through the inferior strata of the atmosphere, that in their convex curvature toward the surface of the Earth, they are confounded with the rays of the nearer stratum of the sea? We can judge only from the direction of the rays; and those rays, which really arrive from the most distant strata of the water, being inflected, appear to us to belong to the nearest. It is this circumstance, which occasions the appearance of streaks, and which augments that intensity of colour or brightness, remarked in the new horizon.

" All these phenomena are equally observable in the barren steppes of Caraccas, and on the borders of the Oroonoko, in those places where sandy plains surround the river. We have frequently seen the mirage this year, 1800, between Calabozo and San Fernando de Apure; and at the Oroonoko, to the north of the Mission of Encaramada. The little hills of San Juan and Ortiz, the chain called Galera, appear suspended, when seen from the steppes, at three or four leagues distance. The sand, at noon, was heated (in the sun) as high as 42° Reaumur. At eighteen inches above the surface, the thermometer kept at 32° Reaum. At six feet (in the shade) it marked 29·5° R. Palm-trees, standing single in the Llanos, appeared to be cut off at bottom: it seemed as if a stratum of air separated them from the ground. The plains, destitute of vegetation, appeared to be meers, or lakes. It is the illusion so common in the African deserts. At the Mesa de Pavones, in the middle of the steppes of Caraccas, Mr. Bonpland and I saw cows suspended in the air. Distance one thousand toises. Measuring with the sextant, the breadth of the aërial interval, we found the animal's feet elevated above the soil 3′ 20″. Simple snspension, no double image. I was

assured, that horses had been seen, near Calabozo, suspended and inverted, without exhibiting any direct image."

All that precedes was written at Cumana, toward the end of 1800. The last phenomenon was reported to me by persons of good authority. It appears to me analogous to that described by Mr. Vince, which Mr. Biot has so well explained in his "*Recherches sur les Réfractions extraordinaires*," 1810, p. 239, fig. 40 bis. Two images of a ship were seen, the uppermost of which was inverted. In the work I have just quoted, Mr. Biot has discussed a part of the measurement I took during my stay in the torrid zone. The following is the reduction of the zenith distances (ancient sexag. division, for the days of the greatest suspension.

DATES of the OBSERVATIONS.	Summit of the Island Boracha.	Summit of the Island Picuita.	Basis or Foot of Picuita.	Depression of the horizon of the Sea.
2d of September 23h -	89° 55′ 33″	90° 5′ 23″	90° 7′ 5″	90° 7′ 40″
6h -	89 55 33	90 5 20	90 6 19	- - -
3d of September 19h -	89 55 30	90 4 23	90 7 6	90 7 43
6h -	89 55 47	90 4 27	- - -	- - -
4th of September 5h ¼	89 55 46	90 4 36	90 6 52	90 6 48
5th of Sept. twilight -	89 56 0	90 4 33	90 6 44	90 7 34
at 6h -	89 56 0	90 4 36	90 6 48	90 6 51
Evening twilight -	- - -	90 4 55	- - -	90 6 10
Later - - -	89 56 2	90 4 36	- - -	90 6 57
24th of September 21h	- - -	90 6 48	- - -	90 14 17

On examining the angles of altitude, under which the summits of the islands of Boracha and Picuita are seen, we find, that the extent of the variations decreases with the magnitude of the angles. The oscillations of the horizon were 7′ 57″; those of the summit of Picuita, 2′ 25″; those of the summit of Boracha, 0′ 27″. The real depression of the horizon, independent of any refraction, ought to be 5′ 29″: I found it between 6′ 10″ and 14′ 17″. In all these cases the refraction was negative; that is to say, the trajectories described by the luminous rays were convex toward the surface of the water, at least in their inferior part. We find too, that the apparent base of the island of Picuita was not always placed above the apparent horizon of the sea. It sometimes came down to the same height, as on the 5th of September at sunset. The island, of course, then appeared resting on the horizon. Sometimes the bases of the island appeared even lower than the apparent horizon of the sea, as on the 4th of September; and the surface of the sea was seen then a little beyond the island. "During these variations the trajectories of the luminous rays were convex toward the sea, at least in their inferior part, as the depression of the horizon proves; but the point of contact of the limiting trajectories with the surface of the sea was more or less distant from the eye; and it was this circumstance that produced the variations observed in the suspension of the islands, which were seen sometimes more distant, sometimes nearer than the limit." Biot. *Recherch.*, p. 216, 217, 219.

The influence of the rising and setting of the sun, which is so apparent in my observations on Picuita, confirms what Legentil perceived during his abode at Pondicherry. This distinguished traveller constantly saw, during the winter, the horizon of the sea descend thirty-six seconds, when the first ray of the sun began to appear. The sun rose *above* the apparent horizon, *as if it rose out of Chaos.* Biot, p. 225. See also my *Recueil d'Obs. Astronomiques*, tom. i, p. 153.

I frequently remarked, that the two capes of the island of

Boracha were irregularly elevated. The suspended part was at the northern cape five minutes long, and at the southern scarcely two minutes. The first of these capes looks toward the ocean, while the southern side is opposite the continent, and near the island Picuita, which radiates heat during the day. "When the sea is warmer in these latitudes than the air, the difference of their extreme temperatures must always be less on the southern, than on the northern side, whence results a less negative refraction, and consequently a smaller suspension." Biot. p. 238.

During the course of my observations on the coast of Cumana, and in other observations made on the coast of the Pacific Ocean at Lima, I had carefully attended to the influence of the *breadth* of the object on the phenomenon of suspension. I thought I had found: 1st, that in islands with a convex summit, the centre of the island reposes on the horizon, while the extremities are elevated. 2dly, that of two islands of similar form, two of a parallelopiped figure for example, the longest island will be elevated only toward it's ends, while the shortest will be entirely suspended. The fine experiments of Messrs. Biot and Mathieu on mirage have perfectly elucidated the causes of all these phenomena. When a rocky island does not appear like a wall of rocks perpendicularly cut at the two extremities, but is elevated at the centre, it is only the part of the sky that reposes on it's extremities, those strata of air that appear as if nearer the horizon, that can exhibit the phenomenon of mirage. The *aërial band*, the reflected sky, will not be seen under the centre of the island, in that place where it is the most elevated. The same thing will happen, when of two objects of similar form one has a greater length in it's lateral dimensions. "According to the theory of extraordinary refractions near the horizon, the caustic surface rises as it's distance augments. The lateral extremities of an object, being farther off the spectator than it's centre, will then be cut by the caustic at a greater elevation. If the island have little

width, the difference will be imperceptible, and the whole island will appear almost equally suspended in the air. But if we observe an island rather long, the borders of which belong to distances much more considerable than it's centre, the difference of height of the caustic at these various distances may become more apparent, and the lateral extremities of the island will then alone be suspended. If the differences of temperature gradually augment, and the point of contact of the limiting trajectory approach nearer the spectator, or, what is the same thing, if the spectator lower his position, the limiting trajectory may rise above the summit of the island, which will then appear entirely suspended in the air." Biot, p. 212. Thus I find noted in my journal, on the 7th of September, on the coast near the mouth of the Rio Manzanares, at the foot of the *Fuerte de la Bocca,* therm. 19° R.; hygr. 43·2°; height of the eye four feet three inches; at 19^h in the morning, on the quadrant I had conveyed to the seaside, C. 95° 91·3. The body of the island rests on the horizon of the sea. The extremities alone are elevated. Water of the sea near the shore, 20·2° R. At 21^h, therm. 20·2° R.; hygr. 42·8°. C. 95° 91·8, but the whole of the island, the centre as well as the extremities, suspended. Water of the sea covering a shore heated by the Sun, 21.8°. The sand 26° R.

What has just been said, relative to the influence of the length and form of objects on the phenomena of suspension appears to me, to lead to the explanation of a curious passage of Theophrastus, in his book on the *Prognosticks of Wind.* "When the capes (or saliant parts of the coast) seem suspended in the air; or when, instead of one island, *we think we perceive several,* this phenomenon indicates a change of the south wind. When the land appears to you black (detaching itself dark) you will have a north wind; if it appear white (detaching itself light) expect a south wind." *Theophr. de signis ventorum,* 422, *B. edit. Heinsii.* Furlanus translates it thus: si promontoria sublimia, insulæve *si ex una plures ap-*

pareant, austri mutationem indicant. When a distant island is of a height very unequal, it is the variations in the depression of the horizon, and not the inverted image of the sky formed on the lowest parts of the island, that make it look as broken, or divided into several small islands. If Theophrastus meant a multiplicity of images placed one beneath the other, he would not have neglected to mention inverted images. Aristotle in his *Meteorologica*, *Lib. iii*, *cap.* ix, *p.* 577 C, Duval's edition, speaks also of the suspension of capes, and considers it as the effect of a refraction in condensed air.

In the course of my observations on the mirage, I carefully made a distinction between the very frequent cases, when there is *suspension* without *inversion*. Mr. Biot has related the circumstances, in which this phenomenon takes place. He shows (*Rech.* p. 261) that the inverted image may be reduced to such small dimensions, as to become imperceptible. Respecting the variations of colour, to which the horizon of the sea is subject, and the prognosticks of a change of refraction derived from the bands or black streaks*, this phenomenon has not always the appearance of several horizons separated by aërial intervals (Biot, p. 10, 151, 183 and 265). I have never observed these intervals formed by the reflected air; I have merely seen that a great change in the depression is preceded by the formation of streaks in that place, where the new horizon was about to be formed. I have proved above, (chap. iii, vol. ii, p. 67) that near the equator the surface of the sea is almost habitually 1° or 1·5° warmer than the surrounding air. This difference of temperature is considerable enough, to be looked upon as one cause of the *mirage*. Mr. Woltmann observed, that there was a double image, or simply suspension, on the banks of the Elbe, when the water was only two degrees of Fahrenheit (0·8° cent.) higher than the air. We cannot then be astonished, that the *mirage*

* See p. 547.

is so common under the tropics, where the rays reach us gliding over the surface of the ocean. (Brandes, in *Gilbert's Annal.*, tom. xvii, p. 175.)

In the sanscrit, the phenomenon of the mirage is called *mriga trichna*, " thirst or desire of the antelope," no doubt because this animal, *mriga*, compelled by thirst, *trichna*, approaches those barren plains, where, from the effect of the inflection of the rays, he thinks he perceives the undulating surface of the waters.

NOTE E.

The mean temperatures of the year indicate the temperatures that would exist in the various places of the globe, if the unequal quantities of heat emitted in different seasons, and at different hours of the day and night, were *uniformly* distributed in the space of a year. Since the latest investigations of the heat of the interior of the Earth, at various latitudes and heights, we cannot consider as identical the mean temperatures of the lowest strata of the atmosphere and those of the stony crust of the globe. It has been often said, that the mean temperatures were sufficient to determine by one single member the climates of different latitudes; but this assertion is not perfectly accurate. To determine the *climate*, we must know the distribution of heat in different seasons of the year: and two places, as Milan, and Pekin for example, the mean temperatures of which (13°) are the same, may have, the first a winter of + 2·4°, and a summer of 22·8°, and the second a winter of —3°, and a summer of 28°. It is true, that, wherever the mean temperature of the year is above 15°, we do not find a winter the mean heat of which is below 0°. Joining by a curve (an *isothermal*) the places, the mean annual temperatures of which are the

same, we discover, that the distribution of heat between summer and winter takes place according to fixed proportions; that is to say, that the variations do not exceed certain limits: but these oscillations, which I have recently examined in a particular paper (*Mém. de la Société d' Arcueil*, tom. iii,) are still considerable enough, to have a sensible influence on the culture of the plants necessary to man. If we chose to characterize a *vine-climate*, it is not enough to say, that the mean temperature of the year must be above 8·7° or 9°; we must add, that in order to have wine worth drinking, the winter must not be below + 1°, and the summer not below 18·5° or 19°. Now on the New Continent, in the United States, the winters are lower than 0°, in those places, where the mean heat of the year does not exceed 9°. On the isothermal line of 9°, we often see the thermometer fall to — 18° in the range of transatlantic climates.

It results from these considerations, that, to give an exact idea of the climate of a place, we must determine, not only the mean of the year, of the seasons, and of the months, but also the variations which take place at different hours of the day and night during a time of some extent. When we have a great number of observations to calculate from, I believe we ought to determine the annual mean, and the mean of each month, by taking the mean of fifteen years (consequently by the help of 10950 partial observations); and then choose the month, the temperature of which is the nearest to that of the mean of fifteen years, to give as an example of the progress of the thermometer at different hours of the day and night. This method of presenting the observations, as they have been successively made in the space of a month, appears to me preferable to adopting the rule of taking from 10950 observations the mean of each day. To *characterize* a climate, we must not deprive it of what I would venture to call it's physiognomy, it's particular features, the sudden transitions from one temperature to another, the variations

which are accidental but often repeated. It is according to these principles, that I have determined to publish in this narrative a part of the meteorological observations I made between the tropics at different heights. If we reflect on the situation of a traveller, who cannot observe at fixed hours, and who must divide his attention among a great number of objects at a time, we must not be surprised to find interruptions, where we could wish for a continued series of observations. I have added to the temperatures of Caraccas, those of Cumana, noted by Don Faustin Rubio. They are both expressed in degrees of Reaumur's thermometer, divided into 80°. The instruments were placed in the open air, in the shade, remote from any reflection from walls or the ground. The hygrometer was that of Deluc; it has not been corrected by the temperature, so that it indicates only the apparent humidity. The observations at Cumana are preceded by a C, and belong to the same hours: for ex. the 28th of October the temperature of the air at Caraccas was, at noon 18·4°; at Cumana (in the suburb of the Guaiqueria Indians), according to a thermometer compared with mine, 23·2°. In order to avoid continually adding the words morning and evening, the time is reckoned according to the method of astronomers, so that here, as in the Journal of the voyage, vol. ii, p. 129—142, 22^h answer to ten in the morning.

Caraccas. Trinidad quarter; Lat. 10° 30′ 50″. Long. 69° 25′. Height, 454 toises. Mean temperature of the year 17·2° R. See above p. 458.

NOVEMBER. 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
28.			
0h	18·4°	48·2°	clear (C. 23·2°).
8	15·0	53·2	fog.
11	14·2	54·2	clear.
29.			
20	14·0	54·0	clear (C. 21·7°).
21	15·2	53·2	
23	18·1	50·0	
1	19·2	47·3	(C. 24·1°).
9	15·6	54·0	
11	15·0	53·2	
30.			
20	14·0	54·2	blue (C. 21·3°).
1	18·2	49·7	
3	18·0	48·2	(C. 24°).
4½	18·0	47·3	blue.
5½	17.1	48·0	
8½	14·5	53·2	blue (C. 22·2°).
9½	15·0	52·0	
11	14·7	53·2	clouds very low.
December 1.			
19½	13·0	51 3	blue (C. 21·2°).
21½	15·0	51·3	
22	16·5	49·5	
23	17·2	47·7	blue.
0	18·0	46·9	
0½	18·7	45·4	
1	19·0	44·7	blue (C. 24°).

DECEMBER 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
2.			
23^h	17·5°	48·2°	cloudy.
0	18·0	47·9	(C, 23·5°).
5½	16·5	48·7	cloudy.
11	15·5	52·2	rain.
3.			
20½	14·9	50·7	blue.
21½	16·0	49·9	wind violent, east.
0	17·5	47·8	
2½	18·0	47·2	(C. 23·6°).
1½	18·2	46·8	
7	15·5	49·7	blue.
11	14·0	53·2	(C. 21·7°).
4.			
20	15·0	51·0	azure (C. 20·2°).
21	15·3	50·4	
22	16·2	48·1	
4½	18·4	43·8	(C. 23·5°).
7½	14·8	46·3	
9	13·5	47·9	fine moon-light.
11	13·2	47·3	blue (C. 21·3°).
5.			
21	15·0	48·7	azure sky with clouds.
22	15·5	47·5	cloudy.
22½	16·3	46·5	
23½	17·3	45·9	
0	18·2	45·3	azure sky, windy.
1	18·0	43·9	(C. 23·5°).
4	18·0	42·9	
5	17·3	42·9	blue.
11	13·5	46·3	calm (C. 21·5°).

DECEMBER. 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
6.			
20^h	12·2	49·2°	fog.
$20\frac{1}{2}$	12·8	49·4	cloudy (C. 20·4°).
21	14·0	50·2	
$21\frac{1}{2}$	15 2	50·3	blue.
23	17·0	46·2	clouds (C. 23·1°).
0	17·5	45·0	
4	18·2	41·6	
5	17·0	44·2	blue.
$6\frac{1}{2}$	15	43·6	
7.			
19	12·5	51·6	azure (C. 19·5°).
20	14·0	51·2	
21	15·2	49·7	
22	16·5	48·2	
23	17·7	47·5	Silla clear.
$0\frac{1}{2}$	18 5	45·0	(C. 23·2°).
$3\frac{1}{2}$	18·0	46·8	
7	16	48·2	azure sky.
$10\frac{1}{2}$	13·5	50·2	
$11\frac{1}{2}$	13·7	50·7	(C. 21·7°)
8.			
$16^h\frac{1}{2}$	12·5	49·2	blue.
18	12·3	49·2	sun rising.
20	13·4	49·7	cloudy (C. 20°).
21	13.4	50·2	
5	16·7	48·2	cloudy (C. 22°).
8	15·0	51·1	
14	14·5	52·9	foggy.

DECEMBER. 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
9.			
$23^{h}\frac{1}{2}$	17·3°	50·2°	blue, with clouds.
$3\frac{1}{2}$	18·2	45·3	blue, calm.
$4\frac{1}{2}$	18·0	45·3	(C. 23°).
7	16·2	49·2	
8	15·0	50·3	blue.
9	14·2	53·2	
10	15·0	52·7	cloudy.
11	15·2	52·2	blue.
11.			
$0^{h}\frac{1}{2}$	17·5	46·3	cloudy (C. 22·8°).
7	16·2	51·1	
11	15·0	52·2	blue.
12.			
$19^{h}\frac{1}{2}$	12·7	50·7	serene (C. 20°).
4	17·0	45·4	
9	13·2	49·5	azure sky.
$12\frac{1}{2}$	14·0	49·5	*id.* (C. 21·3°).
13.			
$1^{h}\frac{1}{2}$	18·1	46·3	blue (C. 22·6°).
$3\frac{1}{2}$	17-5	46·3	
5	16·2	47·2	cloudy.
12	15·0	52·3	(C. 21·3°).
14.			
21^{h}	15·0	51·1	cloudy (C. 20·8°).
$21\frac{1}{2}$	16·5	50·9	
22	16·5	50·2	
23	17·0	49·7	cloudy.
0	17·0	49·5	(C. 21·7°).

DECEMBER. 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
14.			
6^h	15·2°	51·6°	
$7\frac{1}{2}$	15·5	53·2	
11	14·5	55·7	Silla clear.
15.			
22^h	16·5	50·2	azure sky.
$0\frac{1}{2}$	18·5	47·3	Silla foggy.
$2\frac{1}{2}$	17·8	47·3	(C. 22·6°).
5	17·5	49·9	
6	16·3	51·0	very low clouds.
$6\frac{1}{2}$	16·0	51·6	
9	15·0	53·6	cloudy.
10	15·1	53·5	cloudy.
11	15·0	53·2	(C. 21·7°).
16.			
$20^h\frac{1}{2}$	16·2	48·7	blue (C. 20·4°).
22	16·5	48·7	very low clouds.
$23\frac{1}{2}$	17·5	47·0	
0	18·0	46·3	(C. 22·6°).
$5\frac{1}{2}$	17·3	47·0	very fine.
7	16·0	49·5	Silla clear.
9	15·5	50·5	
11	15·2	51·1	(C. 21·3°).
17.			
$23^h\frac{1}{2}$	16·5	49·2	cloudy.
0	17·5	47.2	
1	17·7	46·3	
2	18·5	45·0	(C. 23.1°).
4	16·7	48·7	cloudy.

DECEMBER. 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
18.			
19h	13·0°	53·2°	(C. 20°) cloudy.
20	14·2	52·2	
21	16·0	50·1	
22	16·8	49·0	cloudy.
0	18·5	46 1	
1	18·6	44·9	(C. 22·6°).
3	18·5	44·5	cloudy.
6½	15.8	49·0	azure sky.
19.			
19	14·5	52·2	(C. 20·4°). cloudy.
20	15·0	51·9	
22½	16·3	50·8	wind violent, east.
1	17·7	48·0	(C. 22·2°).
3½	17·0	47·5	cloudy.
5	17·1	48·0	calm.
7½	15·5	51·0	
8½	15·3	51·0	cloudy.
12	14·8	53·5	(C. 21·0°) rain.
20.			
19	14·3	54·9	(C. 20·4°) cloudy.
21½	16·0	51·8	wind violent, east.
22½	16·8	49·9	
23½	17·0	47·8	cloudy.
3½	17·4	44·4	(C. 22·6°).
4	17·5	43·0	azure sky.
7½	15·2	50·1	
11	12·5	53·2	(C. 21·3°) cloudy.
21.			
21	14·5	53·7	cloudy.

DECEMBER. 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
21.			
22½h	13·5°	56·8°	rain.
23	16·0	55·7	
0	15·5	55·7	rain.
1	15·3	54·9	(C. 22·6°).
4	14·9	53·2	
5	14·5	53·3	
9	14·0	54·4	cloudy.
11	14·3	54·9	(C. 21·3°).
22.			
23	16·0	48·7	cloudy.
0	17·2	46·3	
1	17·7	45·4	(C. 23·1°).
5	17·1	45·8	
8	15·0	53·7	cloudy,
11	14·2	54·9	(C. 21·3°).
23.			
22	16·0	50·2	cloudy.
23	16·2	49·7	
0	16·7	49·0	
0½	17·5	48·2	
1	17·8	47·9	
3½	18·2	45·4	some clouds.
4½	17·3	45·9	blue.
5	17·0	46·2	
8	15·1	50·1	
10	14·2	51·8	
11	13·4	54·9	blue.
24.			
22	17·2	47·6	blue.

DECEMBER. 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
24.			
23^h	17·5°	47·6°	wind violent, east.
1	18·0	46·3	
$3\frac{1}{2}$	17·2	48·2	calm.
7	16·1	53·2	cloudy.
8	15 4	54·2	
10	14·7	54·9	
14	14·3	57·8	
25.			
23	17·0	49·7	cloudy.
0	16·5	51·1	rain.
3	15·3	57·8	cloudy.
7	15·0	57·6	
11	14·2	58·8	cloudy.
26			
$21\frac{1}{2}$	17 0	53·2	cloudy.
$22\frac{1}{2}$	16 5	52·3	
0	17·7	48 9	
$0\frac{1}{2}$	17·9	48·2	
$4\frac{1}{2}$	17·5	45·2	blue.
6	15·4	48 3	
8	15·0	52 2	cloudy.
27.			
21	16·0	51·0	some clouds.
0	17·8	46·8	blue.
$3\frac{1}{2}$	18·2	40·7	Silla clear.
6	17·0	41·6	
11	13·2	54·2	blue.

DECEMBER. 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
28.			
20^h	12.2°	52·0°	
21	12·5	55·7	foggy.
22	15·0	54·9	a little blue.
11	16·2	49·2	
1	17·5	45·5	
3½	17·7	42·7	
4	18·0	42·0	blue.
9	14·2	51·0	starlight.
11	16·0	53·2	cloudy.
29.			
20	14·0	52·2	azure sky.
21	14·8	53·2	
22	16·0	51·0	
23	17·2	48·2	
1	17·5	47·2	azure sky.
10	14·6	54·9	cloudy.
30.			
20	15·0	50·2	blue.
22½	17·2	47·2	
23½	17·5	45·0	
0	18·5	44·5	
1	18·5	43·6	
3	18·0	39·7	blue.
4½	18·1	44·4	
10½	15·2	49·2	cloudy.
31.			
20	15·0	50·2	blue.
22½	17·0	47·3	

DECEMBER. 1799.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
31.			
23h½	17·5°	45·0°	
0	18·2	44·5	
1	18 5	43·6	
3	18·0	39·7	blue.
4½	18·0	44·5	
10½	15·2	49·2	cloudy.
1st. Jan.			
9h	15·5	49·2	azure sky.
11½	10·0	54·9	completely cloudy.
4.			
4	18·3	40·7	azure sky (C. 23·5°).
9	15·7	48·2	azure sky.
11	15	51·6	cloudy (C. 21 7°).
8.			
22	16·5	44·1	blue.
0	19·0	40·7	(C. 22·2).
7	15·5	48·2	
11	15·0	47·5	blue (C. 21·3°).
9.			
22½	17·5	45·0	blue.
1	19·5	43·6	(C. 23·5°).
3	18·4	45·7	cloudy.
5	17·5	45·6	
12½	15·0	48·2	cloudy (C. 21·7°).
10.			
20	15·0	49·2	cloudy (C. 21°3).
21	16·2	48·1	

JANUARY. 1800.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
10.			
3^h	19·0°	40·7°	blue (C. 23·0°).
4½	18·2	41·6	
10	14·5	49·2	
1½	14·0	49·0	starlight (C. 21·4°).
11.			
1	19·2	41·7	blue (C. 22·6°).
4	19·0	39·6	
5½	17·5	41·7	cloudy.
7	15·0	46·3	starlight.
12.			
1	18·8	37·6	blue (C. 22·7°).
4	19·0	35·9	
9	14·5	46·0	
13	13·0	44·5	starlight (C, 21·3°).
13.			
21	13·2	44·1	some clouds.
0	17·1	40·7	
1	18·0	40·1	blue (C. 22·6°).
3½	17·2	41·7	
4½	17·0	42·6	
12½	12·5	43·8	starlight (C. 20·4°).
14.			
20½	15·0	44·5	blue, (C. 18·6°).
11	17·2	41·3	
1	17·5	40·1	(C. 22 2°).
3½	18·3	38·3	blue.
5½	15·7	44·3	
9	14·3	47·2	cloudy.
11	13·5	49·3	cloudy (C. 20·8°).

JANUARY. 1800.	THERM. Reaumur.	Whalebone HYGROM.	OBSERVATIONS.
15.			
22h	16·5°	41·7°	cloudy.
1	17·6	41·7	blue (C. 22·2°).
3½	18·0	41·9	cloudy.
4½	16·7	42·7	
9	15·0	43·6	
11	14·5	44·0	starlight (C. 21·3).
16.			
17	13·2	45·4	blue (C. 20·0°).
0	18·0	41·7	
4	16·5	45·3	Catia wind (C. 22·2°).
7	15·2	48.2	cloudy.
10	14·0	48·5	cloudy (C. 21·8°).
17.			
20	13·3	47·2	blue (C. 19·5°).
3½	18·7	39·6	(C. 22·6).
12	14·0	42·7	starlight (C. 21·3°).
58.			
21	16·0	45·4	azure sky.
1	19·2	38·6	(C. 23·5°).
3½	19·3	36·9	
5½	18·5	41.7	azure sky.
11	14·6	44·9	cloudy (C. 21·7°).
22.			
0	19·0	33·8	blue (C. 22·6°).
6	16·3	36·9	
11½	15·1	45·4	blue (C. 21·2°).

Observations made simultaneously at Cumana and Caraccas, at the extremities of a column of air nine hundred metres (four hundred and fifty toises) high, appear to me very interesting. Though the port of Cumana is farther than La Guayra from Caraccas, this port presents a point of comparison much more certain. The air circulates more freely round Cumana, and it's temperature is less influenced by local causes. Comparing, among the whole of the observations, twenty-one fine days, chosen indiscriminately in the months of November, December, and January, I find, on calculating the mean temperature of each day from the maximum and minimum observed, the following results :

DAYS.	Mean Temperature of the days at		Differences.
	Cumana.	Caraccas.	Reaumur.
29 Nov.	22·9°	16·6°	6·3°
30	22·6	16·0	6·6
1 Dec.	22·6	16·0	6·6
3	22·6	16·1	6·5
4	21·8	15·8	6·0
5	21·7	15·7	6·0
6	21·7	15·1	6·6
9	21·7	16·6	5·1
12	21·3	14·8	6·5
15	21·6	16·7	4·9
4 Jan.	21·9	16·6	5·3
8	20·8	17-0	3·8
9	22·4	17·2	5·2
12	22·0	16·0	6·0
13	21·7	15·2	6·5
14	20·4	15·9	4·5
15	20·8	16·2	4·6
16	21·1	15·6	5·5
17	21·0	15·6	5·4
18	21·0	16·8	4·2
19	21·5	17·0	4·5

The mean temperatures of twenty-one fine days differed at Cumana 3·4°; at Caraccas, 3° cent. therm. The least differences between the mean temperatures of the two places did not always take place, when the weather was hottest at Caraccas; they oscillated between 4·8°, nnd 8·2°. The mean of all the differences was 6·8° (5·5° Reaumur), nearly one-hundred and thirty-two metres to a centesimal degree. The valley of Caraccas is colder than it should be for an elevation of nine hundred metres, and this circumstance renders the decrement of heat extremely rapid. The mean of all my observations made between the tropics gave me, for the first strata of air comprised between the level of the sea and one thousand metres of elevation, one hundred and seventy metres corresponding to 1° of the cent. therm., or one hundred and nine toises to 1° of Reaumur.

SUPPLEMENT.

The desire I had manifested to see the Archipelago of the Canary Islands examined with respect to geology, and natural philosophy, and the geography of plants, by travellers who could make a long stay there, has been lately realized. Mr. Leopold von Buch is now preparing an extensive work, the result of his laborious investigations on Teneriffe, and the neighbouring Islands. To this great geognost, and to the researches of Mr. Smith, who has lately fallen a victim to his zeal for the sciences in the expedition on the river Congo, I am indebted for the Physical Map of the Peak of Teneriffe. I have not hesitated to substitute more accurate notions in the place of those communicated to me by Mr. Broussonnet, (see vol. i, p. 260—271). Mr. von Buch distinguishes, 1st, the region of African forms, 0—200 toises; 2d, the region of vines and grain, 200—430 toises; 3d, the region of the laurels, *regio sylvatica*, 430—680 toises; 4th, the region of the *pinus canariensis*, 680—980 toises; 5th, the region of the retama, *spartium nubigenum*, 980—1730 toises. The retama is found only at Teneriffe. It's inferior limit is at 1000 toises. The mountains of all the other islands, excepting Palma, are not high enough to enter this limit, and the summit of the Pico de lo Muchachos in Palma is composed only of naked and barren rocks. The gramineous plants are very rare; and, as Mr. von Buch observes, they do not form a particular zone. The plants

that do not belong to the Peak of Teneriffe, but which grow at the indicated heights on the mountains of the neighbouring islands, are placed between two parentheses. An S (Smith) is added to the new species, which will be published by Messrs. von Buch and Smith. A cross placed at the end of a word marks the superior limit of a plant, that at which it ceases to grow.

I shall mention some other ideas, for which I am indebted to the communications of Mr. von Buch, and which will serve to rectify what I have stated in the second chapter of this Narrative. I eagerly seize every opportunity of rectifying this work from the report of learned persons, who have visited the same places, and who have remained in them longer than myself. "The Canarian pine (vol. i, p. 268) is certainly a new species, till now unknown to the botanists of Europe. The dragon-tree (ib. p. 142) does not appear to belong to the East-Indies, as Linneus believed; it is found wild near Iguesta, 170 or 200 toises above the level of the ocean. The thorny plant of Lancerota, which Mr. Broussonet had taken for a sonchus (ib. p. 236 note), is the prenanthes spinosa. The volcano of Lancerota, which I had judged to be 300 toises high from angles which I took when under sail (ib. p. 82), is the Corona, the elevation of which, according to an extremely accurate barometrical measurement is 292 toises. The height of the town of Laguna which had never been exactly determined (ib. p. 120; and vol. ii, p. 178) is 264 toises. No circular wall of lava prevents entering the crater of the Peak of Teneriffe on the northern and western side. What I said of this wall and the analogy between the summit of the Peak and that of Cotopaxi (vol. i, p. 169) does not appear to be accurate. No subsequent observation has confirmed the assertion of Mr. Broussonet (ib, p. 235), that the island of Gomera contains a nucleus of granite and mica-slate; but Mr. Escobar, a learned Spanish mineralogist, has found in the island of Fortaventura a block of primitive syenitic rock. It is a mass, the basis of which

is feldspar, containing crystals of hornblende. Mr. von Buch has discovered in the great Circus of the island of Palma, which he considers as the ancient *cratère de soulèvement*, crater of eruption, another primitive rock. This also consists of a feld-spar basis, containing garnets and actinolite (strahlstein). In a neighbouring ravin isolated blocks of mica-slate with hornblende are observed. The gypseous and limestone formations of Lancerota and Fortaventura (ib. p. 236) are strata subordinate to the formation of volcanic tufs. We even find there beds of oolites. According to Mr. von Buch, to whom belong all the observations of this supplement, the mean temperature of Santa-Cruz in Teneriffe is 71·8° Fahr., or 21·8° Centigrade."

In this Personal Narrative all the indications of temperature are reckoned in the degrees of the centesimal thermometer, when the contrary is not expressly noted. The Generic and specific names of plants printed in italics designate genera or species unknown before our journey, and described in our *Nova Genera et Species Plantarum Orbis Novi.*

END OF VOL. III.

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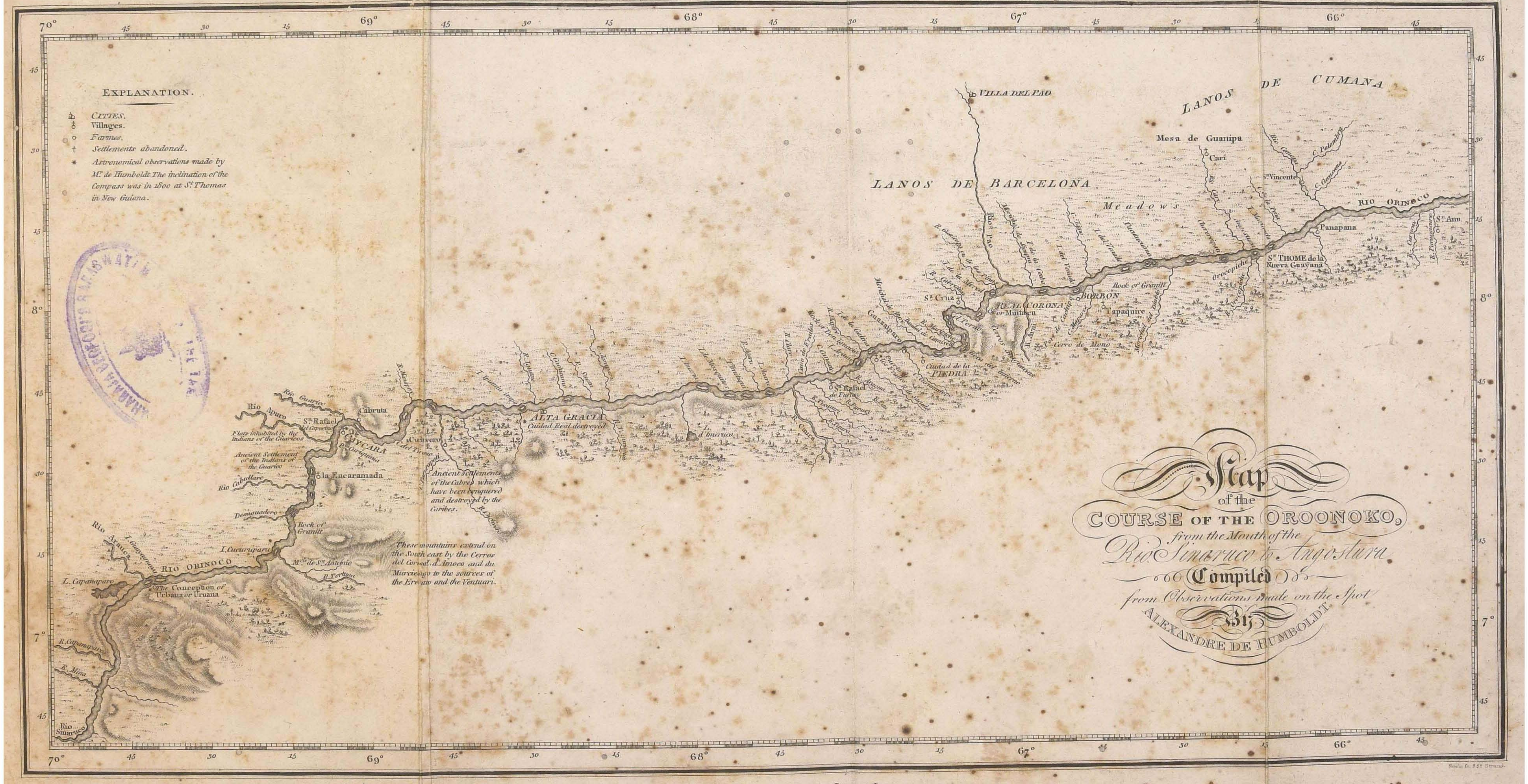

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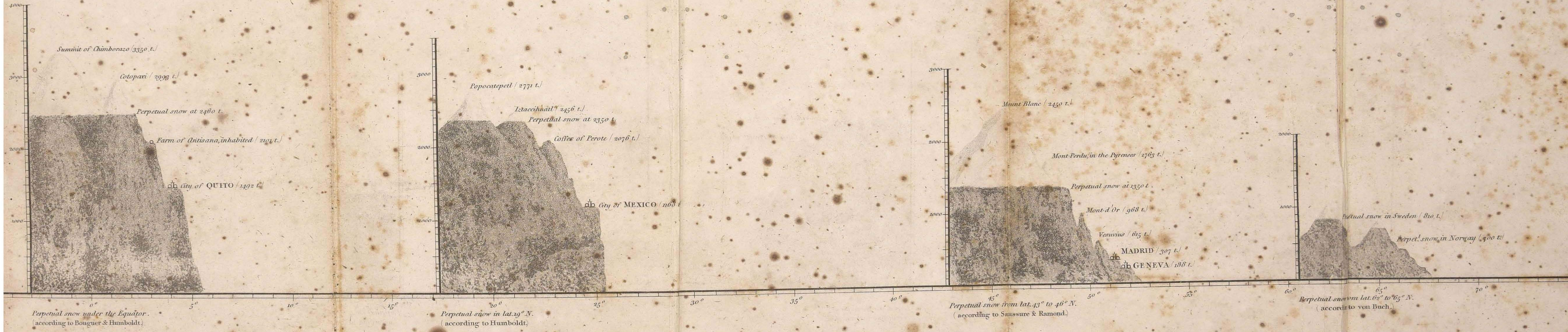

Lower Limit of Perpetual Snow in different Latitudes.

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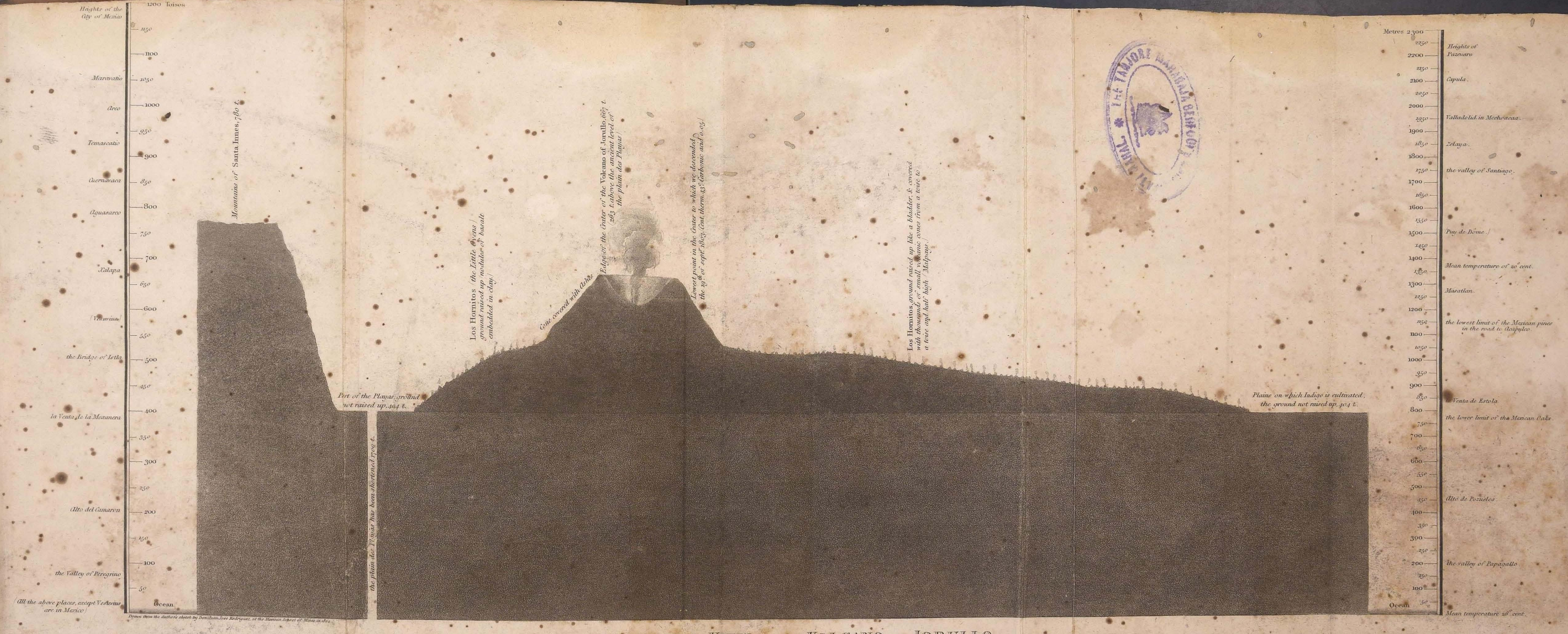

GEOLOGICAL VIEW OF THE VOLCANO OF JORULLO.

From Barometrical Measurements taken on the Spot by Mr. de Humboldt.

The Volcano of Jorullo and the Malpays in the Mexican Province of Mechoacan lat. 19°9'?) N. & long. 103°52'5" W. rose out of the Ground in the Month of September 1759.

Scale of 400 Toises 100 200 300 400 *The Scale of heights is to that of distances as 3 to 2*

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